BLUE·TREE
WIRELESS DATA INC.

BlueTree 4000 & 5000 Series CDMA Modems

User's Guide

 Copyright © 2007 BlueTree Wireless Data Inc.

BlueTree Wireless Data, Inc.
2425 46th Avenue
Lachine, QC, Canada H8T 3C9

Tel: +1 (514) 422-9110
Toll Free: 1-877-422-9110
http://www.bluetreewireless.com

Copyright © 2007 BlueTree Wireless Data, Inc.
All Rights Reserved
Printed in Canada
BlueTree™, the BlueTree logo, and BlueVue™ are trademarks of BlueTree Wireless Data, Inc.
All other trademarks are the property of their respective owners.

Liability Notice

While every effort has been made to achieve technical accuracy, information in this document is subject to change without notice and does not represent a commitment on the part of BlueTree Wireless Data, Inc., or any of its subsidies, affiliates, agents, licensors, or resellers. There are no warranties, express or implied, with respect to the content of this document.

Declaration of Conformity

FCC Compliance and Industry Canada Statement

4200/5200	FCC	O9EQ2438
	IC	3651C-Q2438
4600/5600	FCC	QWV-BTX600
	IC	4420A-BTX600
4600A/5600A	FCC	QWV-BTX600A
	IC	4420A-BTX600A

The device complies with Part 15 of FCC rules and with ICES-003 of Industry Canada Rules. Operation is subject to the following two conditions:
This device may not cause harmful interference.
This device must accept any interference received, including interference that may cause undesired operation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the manufacturer's instructions, may cause interference harmful to radio communications.
However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

Warning: "The antenna gain including cable loss must not exceed 3 dBi for operation under part 22 subpart H Cellular band and 4 dBi for operation under part 24 subpart E PCS band. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 30 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users must be provided with specific information required to satisfy RF exposure requirements."

 Copyright © 2007 BlueTree Wireless Data Inc.

Table of Contents

Section 1: Package Contents....6

Section 2: Product Overview....7

2.1 Introduction....7

2.2 Features....8

2.3 Specifications....10

2.3.1 General specifications....10
2.3.2 I/O Specifications....11
2.3.3 Power specifications and consumption....12
2.3.4 GPS specifications (5000 series modems only)....13

2.4 Modem Views....13

2.5 Indicators Lights (LED)....14

2.6 Data Interface Specifications: Serial, Ethernet & USB....16

2.6.1 Ethernet Port....16
2.6.2 USB Device Port....16
2.6.3 Serial Port (DB9)....16

Section 3: BlueVue Device Manager....17

3.1.1 Connecting to the modem....17
3.1.2 Software overview....19

Section 4: Activation & WAN Setup....20

4.1 Activation....20

4.1.1 Get an account for the modem....20
4.1.2 Program the account information into the modem....20
4.1.3 Confirm the success of activation....21

4.2 WAN Setup....22

4.2.1 Enter the account information....22
4.2.2 Test the connection....23

Section 5: LAN Setup....24

5.1 Ethernet and USB LAN....24

5.1.1 LAN configuration....24
5.1.2 DHCP server....25

5.2 Dial-up Networking (DUN) over serial....27

Section 6: IP Networking Features....28

6.1.1 Port-forwarding....29
6.1.2 DMZ....30
6.1.3 IP Pass-through....30
6.1.4 Dynamic IP registration....31
6.1.5 Password protection....32

Section 7: Serial-IP....33

Section 8: I/O Management....34

Section 9: GPS Settings....35

Section 10: Event Reporting....37

Section 11: Hardware Installation....38

11.1 Cellular antenna....38

 Copyright © 2007 BlueTree Wireless Data Inc.

11.2 Antenna diversity 39
11.3 GPS antenna.....39
11.4 Ethernet cable.....40
11.5 USB cable.....40
11.6 Serial cable.....40
11.7 Power source.....41
11.7.1 Powering up the modem.....42
11.7.2 Testing the power connection.....42
11.8 I/O Cable Wiring.....43
11.8.1 Connecting a panic button or a passive on/off sensor to the modem's digital input:.....44
11.8.2 Connecting an active voltage source to the modem's digital input:.....45
11.8.3 Turning on and off an external peripheral using a power relay on the modem's digital output:.....46
11.8.4 Connecting an analog gauge or source (0-5Vdc) to the modem's analog input:. 47
11.8.5 Connecting an analog gauge or source (4-20mA) to the modem's analog input: 48
11.9 Mounting the modem.....48
Appendix A : Firmware Upgrades.....49
Appendix B : Sending AT Commands.....52
Appendix C : Basic GPS Reporting in BlueVue Device Manager.....54
Appendix D : Dial-Up Networking in Windows.....57
Appendix E : BlueVue Device Manager Troubleshooting.....59
Appendix F : Activation Troubleshooting.....63
Appendix G : Application & Miscellaneous Troubleshooting.....65
Section 12: Warranty.....68

 Copyright © 2007 BlueTree Wireless Data Inc.

Section 1: Package Contents

The modem's retail package contains the following items:

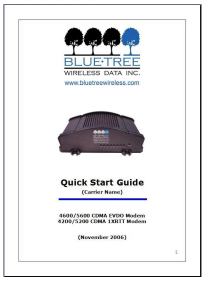
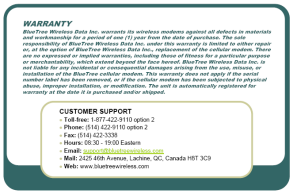
1	4000/5000 Series modem	
2	15-foot power cable with 1A fuse	
3	Extra serial number label	
4	5-foot Ethernet CAT5 cross-over cable	
5	Quick Start Guide (also available at www.bluetreewireless.com)	 BLUE·TREE WIRELESS DATA INC. www.bluetreewireless.com Quick Start Guide (Carrier Name) 4600/5600 CDMA EVDO Modem 4200/5200 CDMA 1XRTT Modem (November 2006)
6	Warranty card	

Table 1 - Package Contents

 Copyright © 2007 BlueTree Wireless Data Inc.

Section 2: Product Overview

2.1 Introduction

The BlueTree 4000 & 5000 series modems are rugged cellular modems built to provide simple and reliable communication over a CDMA cellular data network. They are typically used in applications such as Public Safety, Field Force Automation, Asset Tracking, Telemetry, SCADA, meter reading and WAN backup.

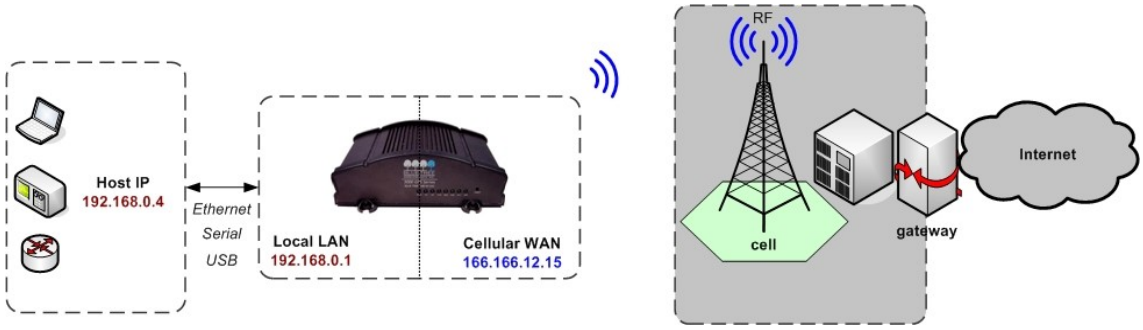


Figure 1

The modem manages two connections at the same time, thus acting as a gateway/router:

- **Cellular WAN connection:** this is the Wide Area Network connection to the cellular network/Internet. The modem can be configured to automatically and autonomously establish a packet data connection to the cellular carrier and acquire a WAN IP address.
- **LAN connection:** this is the local connection between the modem and any device attached to its serial/Ethernet/USB ports. In the case of Ethernet and USB, the modem acts as a server and assigns a private LAN IP address to the attached device. Alternatively, it can perform IP pass-through and assign the WAN IP to the attached host, thus becoming a fully transparent actor in the communication process.

The modem then routes packets back and forth between its WAN and LAN connections, thus allowing the locally attached device to communicate with remote computers.

 Copyright © 2007 BlueTree Wireless Data Inc.

2.2 Features

3 different data connection interfaces	Serial/RS-232/COM, Ethernet, and USB
Autonomous & persistent connection management	Fully integrated TCP/IP protocols allow the modem to connect autonomously to the packet network (Internet). This feature enables capabilities such as: in-call diagnostic, Serial-IP, stand-alone GPS, remote configuration and remote firmware upgrade.
Network Address Translation (NAT)	When packets leave a LAN IP and reach the modem, it performs NATing. The source IP of the packet is modified to match the modem's WAN IP. When packets come back from the WAN the modem then performs a reverse NAT.
IP pass-through	The modem can assign its WAN IP address to the attached host, thus disabling NAT. The modem remains reachable through its reserved TCP and UDP ports.
In-call diagnostic	The user can get modem status information while in a data call, without interrupting the data session
Serial IP	The modem encapsulates data coming from the serial port into a TCP or UDP packet and sends it to a remote server on the packet network. It decapsulates IP packets coming from the network and sends raw data to the serial port.
Remote configuration	The user can remotely configure or perform remote diagnostics on the modem using BlueVue Device Manager or a terminal session
Remote firmware upgrade	The user can remotely upgrade the modem's firmware using BlueVue Device Manager
Password protection	The modem can be protected from tampering by requesting the user to enter a password before the existing modem configuration can be viewed or modified
Integrated GPS Receiver	Available on the 5000 series modems only. A Trimble GPS receiver is embedded into the modem for Automatic Vehicle Location (AVL). The modem can report this positioning data locally to any of the local data interfaces (serial, Ethernet, or Ethernet-over-USB), and/or remotely to a predefined server (see stand-alone).
Stand-alone GPS	Available on the 5000 series modems only. This feature allows remote asset tracking by sending GPS data to a remote server without the need for a client application connected to the modem.
Store and Forward	This feature allows I/O and/or GPS report preservation. If a unit loses its WAN connection, the data being collected through I/O and/or GPS event reporting will be stored in memory and automatically forwarded when the WAN connection is established.

 Copyright © 2007 BlueTree Wireless Data Inc.

Inputs and Outputs	Sensors can be connected to the I/O port of the modem (4 digital inputs, 3 digital outputs and 3 analog inputs). The modem is capable of monitoring its digital input sensors for any change in state and sending a report to a remote server based on an event trigger. The analog inputs allow monitoring of gradient data sources. The modem's outputs can be used to remotely trigger relays.
Event Reporting	The modem can send a report to up to 10 destinations when a user-defined event is triggered. The modem has an intuitive embedded Event Reporting Protocol that automatically formats the messages reported to the remote server.

Table 2

 Copyright © 2007 BlueTree Wireless Data Inc.

2.3 Specifications

2.3.1 General specifications

CDMA Dual-band	Supports both North American frequency bands: 800 MHz and 1900 MHz
CDMA	All modems are compatible with CDMA IS-2000 Cellular data services. Model: **4600A/5600A** modems support **EV-DO Rev.A**, **EV-DO Rel.0** and **1XRTT** **4600/5600** modems support **EV-DO Rel.0** and **1XRTT** **4200/5200** modems support **1XRTT** and **IS95**
Data Rates	Maximum bandwidth: (depends on service provider) **EV-DO Rev.A**: 3.1Mbps downstream, 1.8Mbps upstream **EV-DO Rel.0**: 2.4Mbps downstream, 153Kbps upstream **1XRTT**: 153Kbps downstream and upstream **IS95:** 14Kbps downstream and upstream
Programming/Setup	BlueVue Device Manager software, AT commands
LED Status Indicators	PWR, TX, RX, DTR, REG, LNK, ACT, and SER/GPS
Enclosure & Weight	**Material:** extruded aluminium **Size:** 166 mm × 127 mm × 56 mm (6.55" × 5.00" × 2.20") **Weight:** 500g (1.1 lbs)
Cellular Antenna Connection	**4200/5200 modems:** TNC Female Connector, 50 Ohms **4600/5600 modems:** 2x SMA Female Connector, 50 ohms **4600A/5600A modems:** 2x SMA Female Connector, 50 ohms
GPS Antenna Connection	SMA Female Connector (3.3 Volts active antenna)
Environmental Specifications	**Operating Temperature:** -40° to +85° C (-40° to +185° F) **Storage Temperature:** -40° to +85° C (-40° to +185° F) **Humidity:** 95% non-condensing

Table 3

 Copyright © 2007 BlueTree Wireless Data Inc.

2.3.2 I/O Specifications

The modem has 4 digital inputs, 3 analog inputs and 3 digital outputs for remote control and monitoring. The third digital output (O3) is located on the power connector for all modems. The third analog input (AI3) is not available on the 4200/5200 models.

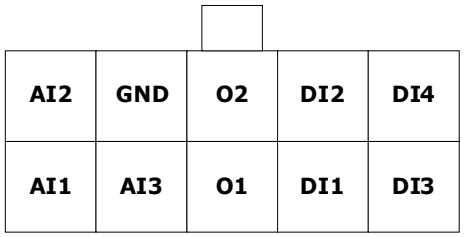


Figure 2 – I/Os (Looking at back of modem)

3x Digital Outputs (O1, O2, O3) – O3 available on Power connector	
Configuration	Open Collector, reference to ground
Absolute Maximum IDC	500mADC (Vce = 750mVDC)
Absolute Maximum VDC	30VDC (open circuit)
Absolute Minimum VDC	0.4VDC (open circuit)
4x Digital Inputs (DI1, DI2, DI3, DI4)	
Configuration	Non-isolated level detection, reference to ground
Active level	1.6VDC to 30VDC
Inactive level	0VDC to 1.3VDC
Absolute Minimum VDC	0.3VDC
Absolute Maximum VDC	33VDC
Leakage IDC at 5VDC	150uADC
3x Analog Inputs (AI1, AI2, AI3) – AI3 only available on 4600/5600	
Configuration	Not isolated input, reference to ground
Resolution	1024 (ADC 10-bit)
VDC per step	4.8875855mVDC
Full scale level	5VDC
Zero level	0VDC
Absolute Minimum VDC	-0.3VDC
Absolute Maximum VDC	8.3VDC
Leakage IDC at 5VDC	265.96 uADC TYPE

Table 4

 Copyright © 2007 BlueTree Wireless Data Inc.

2.3.3 Power specifications and consumption

Power is supplied to the modem via the 4-pin connector on the rear panel. The pins are described as follows:

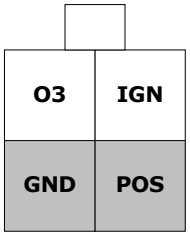


Figure 3 – Power (Looking at back of modem)

Pin	Name	Description
1	GND	Ground
2	POS	Power supply input (8 to 30 Vdc)
3	IGN	Ignition sense input – Switches the modem on or off
4	O3	Digital Output 3

Table 5

- Power input to the modem is protected against reverse polarity and over-voltage
- The POS input is monitored by the modem as a dedicated analog input. Used to monitor the Voltage
- The IGN input is monitored by the modem as a dedicated digital input

The modem's power consumption is as follows:

Mode	Description	Approximate consumption (mA)					
		4200	5200	4600	5600	4600A	5600A
Active (average)	The modem is in a call and is transmitting or receiving data	169	182	179	188	190	200
Active (peak)	The modem is in a call and is transmitting or receiving data	287	300	300	311	330	340
Idle	The modem is either not in a call, or is in one but is Dormant. The modem is Dormant after 20s of inactivity.	49	62	56	67	70	80
Ignition OFF	The modem is turned OFF but still has power from its POS input. All circuitry is shut down except for Non-Volatile memory and Real-time Clock.	1	1	1	1	1	1

Table 6

Wiring instructions are provided in Section 11: Hardware Installation.

 Copyright © 2007 BlueTree Wireless Data Inc.

2.3.4 GPS specifications (5000 series modems only)

General	• L1 frequency (1575.42 MHz) • C/A code (Standard Positioning Service) • 12-channel • Continuous tracking receiver
Update rate	• TSIP @ 1 Hz • NMEA @ 1Hz
Accuracy	• Horizontal: <5 meters (50%), <8 meters (90%) • Altitude: <10 meters (50%), <16 meters (90%) • Velocity: 0.06 m/sec. • PPS (static): ±50 nanoseconds
Acquisition	Autonomous Operation in Standard Sensitivity Mode: • Reacquisition: <2 sec. (90%) • Hot Start: <10 sec. (50%), <13 sec. (90%) • Warm Start: <38 sec. (50%), <42 sec. (90%) • Cold Start: <50 sec. (50%), <84 sec. (90%) Cold Start requires no initialization. Warm Start implies last position, time and almanac are saved by backup power. Hot start implies ephemeris also saved. Optional (COCOM) limits: • Altitude: 18,000 m • Velocity: 515 m/s Either limit may be exceeded, but not both.
Dynamics	• Acceleration: 4g (39.2 m/sec2) • Motional jerk: 20 m/sec3

 Copyright © 2007 BlueTree Wireless Data Inc.

Table 7

2.4 Modem Views

Front	
Back (5600)	

Figure 4

 Copyright © 2007 BlueTree Wireless Data Inc.

2.5 Indicators Lights (LED)

The modem has 8 green LEDs on its front panel providing information on the state of the modem:

LED	Indication	Status	Corresponding State
PWR	Power	OFF	Modem is powered off
		ON	Modem is powered on
TX	Transmit	Flashing	Attached terminal is transmitting data to modem via serial port
RX	Receive	Flashing	Attached terminal is receiving data from modem via serial port
DTR	Data Terminal Ready	OFF	No terminal is detected over modem serial port
		ON	Terminal host is detected over modem serial port
REG	Registration	OFF	Radio is off (contact customer support)
		Flashing	Radio is registered on cellular network
		ON	Radio not registered on cellular network
LNK	RF link	OFF	Not in a data call
		ON	In a data call (connected to network)
ACT	RF activity	Flashing	Transmitting/receiving data over cellular network
SER (4000 series)	SER	This LED is unused	
GPS (5000 series)	GPS	ON	No position fix available
		Flashing	Position fix acquired

Table 8

 Copyright © 2007 BlueTree Wireless Data Inc.

2.6 Data Interface Specifications: Serial, Ethernet & USB

2.6.1 Ethernet Port

The modem's 10/100Mbps Ethernet port is compliant with the EIA-568 standard, and requires a crossover cable to connect to host terminals.

2.6.2 USB Device Port

This is a USB2.0 Device interface on a Type B connector. It offers Ethernet-over-USB functionality using the RNDIS driver.
The BlueTree RNDIS driver must be installed before the USB interface can be used. You can obtain the driver at www.bluetreewireless.com.

2.6.3 Serial Port (DB9)

The modem's serial port is an RS232 DCE, compliant with EIA-232 standard. The connector used is DB9 female and is shown in the illustration below.

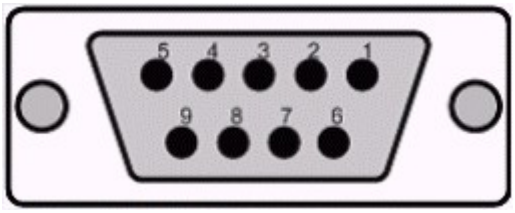


Figure 5 – Serial connector (looking at back of modem)

For further serial wiring information, refer to Section 11: Hardware Installation.

 Copyright © 2007 BlueTree Wireless Data Inc.

Section 3: BlueVue Device Manager

The 4000/5000 series modems can be configured using BlueVue Device Manager, a software application which is available as a free download at www.bluetreewireless.com. Later sections of this guide will refer to configuration options in this program. For more in-depth information on using BlueVue Device Manager, refer to the *BlueVue Device Manager User's Guide*. It can be accessed from within BlueVue itself by clicking the Help button, or downloaded separately at www.bluetreewireless.com.

BlueVue Device Manager is a Graphical User Interface for modem configuration and administration that allows the user to:

- Activate the modem (program the MDN and MIN) for use on the cellular network
- Register the modem on the cellular network (WAN Setup)
- Configure operation parameters (such as LAN setup or GPS)
- Monitor diagnostic and status information
- Perform firmware upgrades on the modem

3.1.1 Connecting to the modem

Should you run into any issues connecting to the modem, refer to Appendix E: BlueVue Device Manager Troubleshooting.

Click on **Tools > Settings > Connection tab** to select the interface that will connect your PC to the modem.

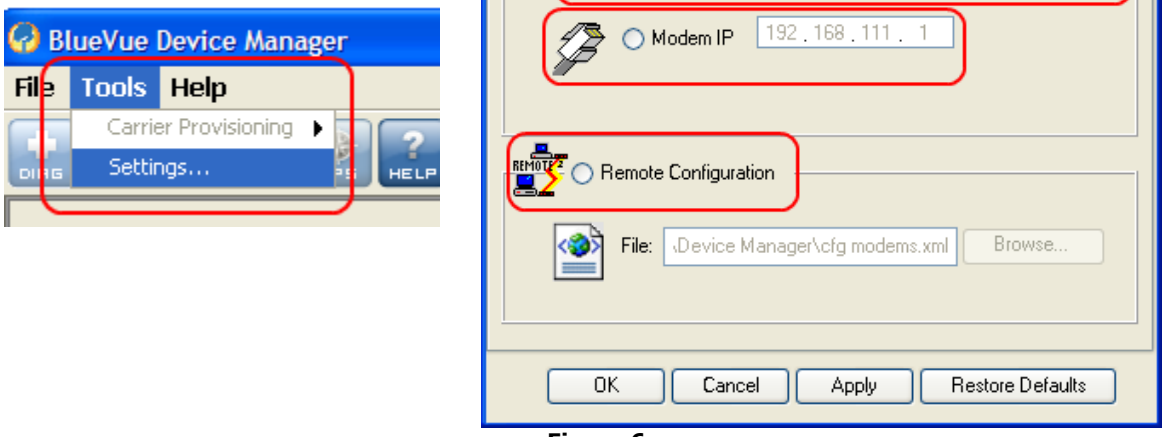


Figure 6

 Copyright © 2007 BlueTree Wireless Data Inc.

If using a serial cable:

1. Select **Serial**
2. Select the **COM** port in the dropdown list, then click OK

If using an Ethernet or USB cable:

1. Select **Modem IP**
2. Enter the appropriate modem **IP** then click OK. By default, the DHCP-assigned IPs will be **192.168.0.1** for Ethernet and **192.168.111.1** for USB. If using USB, the driver must be installed as explained in section 2.

If connecting to a remote modem:

1. Select **Remote Configuration** and click OK. A new panel will open to the left of BlueVue Device Manager.
2. **Right-click Available Modems** in the panel
3. Click **Add...**
4. **Enter the modem's information**, then click OK. The description is optional.
5. The modem will be added to the list of Available Modems, which will be saved for easy access in the future. **Double-click the modem name** in order to connect to it.

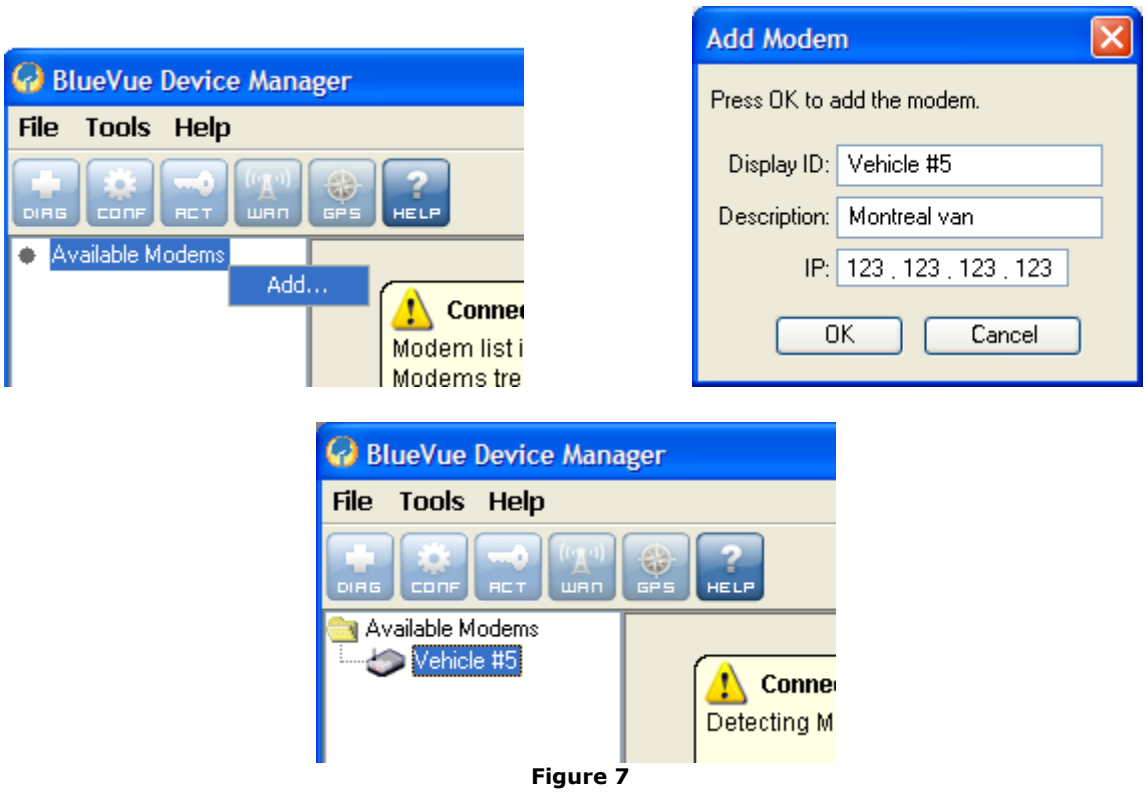


Figure 7

 Copyright © 2007 BlueTree Wireless Data Inc.

3.1.2 Software overview

Modem Diagnostic
This screen displays various technical information pertaining to the modem's state.

Modem Configuration
This screen allows the user to configure the modem to suit the application requirements.

Modem Activation
This screen is where the user performs cellular account activation so that the modem may connect to the cellular network.

Modem WAN Settings
The screen allows the user to set the connection profile on the modem, such as the user name and password of the account.

Modem GPS
The screen allows the user to configure the modem for basic GPS reporting. (Available only for the 5200 and 5600/A modems)

Help
This button opens the *BlueVue Device Manager User's Guide*, a document that explains every parameter of BlueVue Device Manager in detail.

 Copyright © 2007 BlueTree Wireless Data Inc.

Section 4: Activation & WAN Setup

4.1 Activation

A modem must be activated before it can be used on the cellular network. Here are the steps to follow to activate a modem.

4.1.1 Get an account for the modem

Contact a cellular service provider or cellular dealer and request a CDMA account with the packet data service option for 1xRTT, 1xEV-DO, or 1xEV-DO Rev. A. The provider will require the Electronic Serial Number (ESN) of the modem. The ESN is located on the label under the modem as well as on the modem's box.

The cellular service provider will then provide the following account credentials:

- **Mobile Directory Number (MDN)**: the 10-digit telephone number assigned to your unit, including the area code
- **Master Lock Code (MLC/SPC)**: the 6-digit number representing the Service Provisioning Lock Code. If one was not provided, assume it is 000000.
- **Mobile Station ID (MIN/MSID/IMSI)**: the 10-digit or 15-digit number required for Local Number Portability; If not provided, assume it is the same as the MDN.
- **User Name/Password (Optional):** required for network access in some cases.

➢ ***IMPORTANT:*** *Ask your cellular service provider whether the carrier blocks incoming connections. If they do, you will be unable to communicate with the modem remotely unless you ask the service provider to allow incoming connections to your application's TCP and UDP ports. If possible, ask them to open the following ports as well: TCP 21 (used for firmware upgrades), TCP 5070 (used by BlueVue Device Manager), and TCP 6070 (used for troubleshooting and AT command configuration).*

4.1.2 Program the account information into the modem

Open BlueVue Device Manager and navigate to **ACT (Activation)**. The Quick Start Guide booklet included in the modem package contains a step-by-step walkthrough for activating the modem. The Quick Start Guide is also available at www.bluetreewireless.com.

 Copyright © 2007 BlueTree Wireless Data Inc.

4.1.3 Confirm the success of activation

Once the activation process above is complete, navigate to **WAN (WAN Settings)**. The modem's phone number should be displayed at the top left as outlined in the figure below.

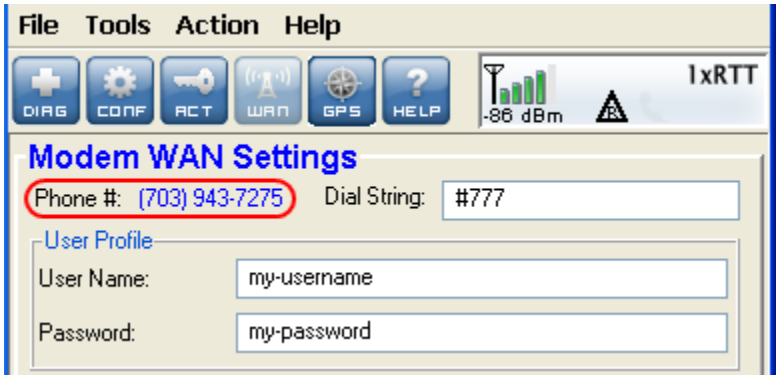


Figure 8

 Copyright © 2007 BlueTree Wireless Data Inc.

4.2 WAN Setup

Once the modem has been activated, it must be configured in order to authenticate for use with the cellular network.

4.2.1 Enter the account information

Navigate to **WAN (WAN Settings)** to configure the WAN connection once the modem has been activated.

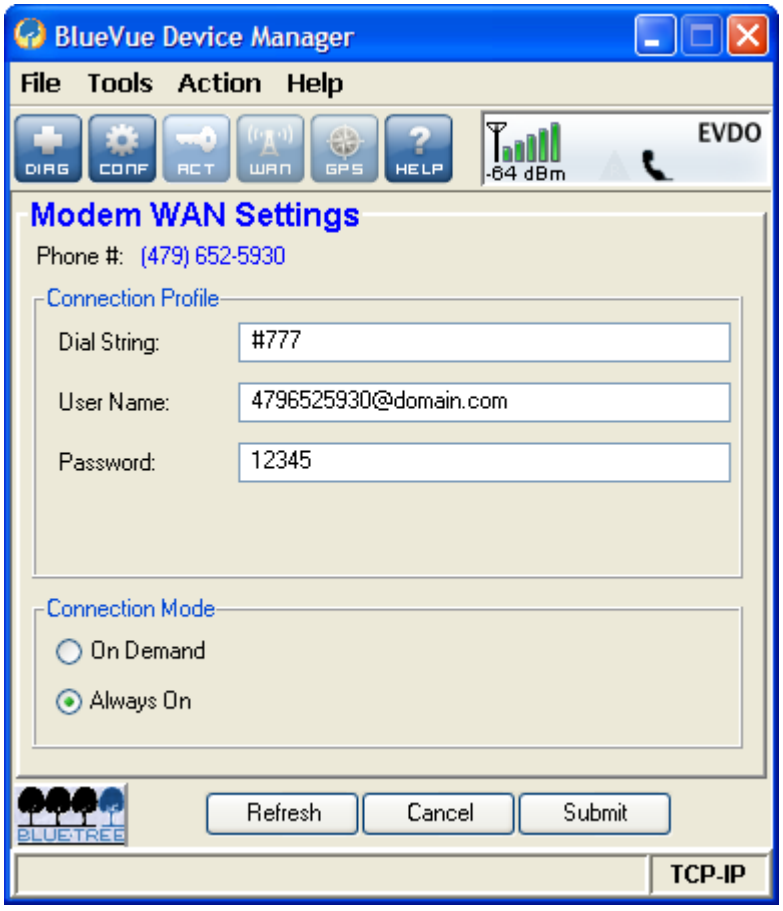


Figure 9

1. Enter **#777** as the **Dial String**
2. Enter the **User Name** and **Password** if provided by your cellular carrier
3. Select **Always On** or On Demand (explained below) depending on the desired connection initiation behavior.

 Copyright © 2007 BlueTree Wireless Data Inc.

Always On & On Demand
When the modem is set to Always On, it will attempt to maintain a permanent connection to the cellular network on its own. Most applications will require the modem to be remotely accessible at any time, and will require the modem to be set to Always On.

When the modem is set to On Demand, the modem does not connect to the cellular network unless told to by the attached terminal. If disconnected from the cellular network, it will not attempt to reconnect. The most common On Demand scenario is when using the serial port in order to establish a PPP session through a Dial-Up Networking (DUN) connection.

Unless you are sure the modem should be set to On Demand, the modem should be set to **Always On**.

4.2.2 Test the connection

Once you've finished entering the settings, and once a connection is established (depending on the connection initiation behavior described above), navigate to **DIAG (Modem Diagnostic)**: the modem's **WAN IP** should be displayed as outlined in the figure below. This is the IP address that has been assigned to the modem by the cellular carrier. At this time, the modem's LNK light will stay on as long as the connection is maintained.

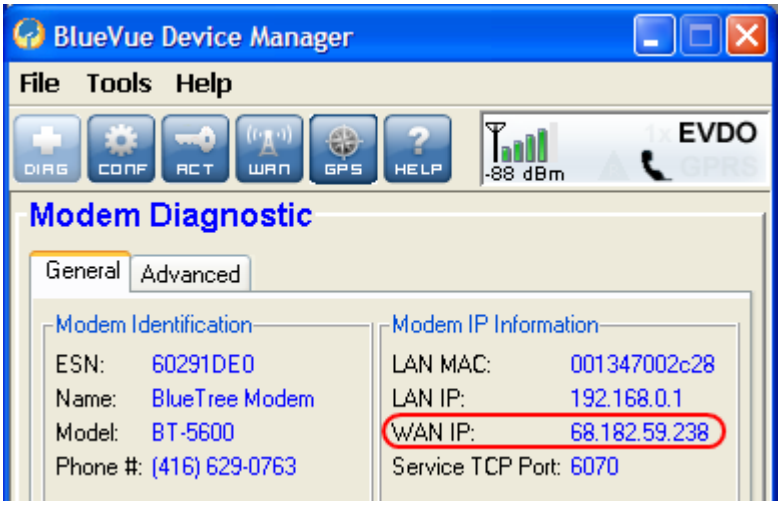


Figure 10

 Copyright © 2007 BlueTree Wireless Data Inc.

Section 5: LAN Setup

5.1 Ethernet and USB LAN

Computers and devices that use the modem's Ethernet and USB connectivity experience much higher transfer speeds and more importantly, they employ all the benefits of TCP/IP communication.

5.1.1 LAN configuration

Whether an Ethernet or USB cable is used, it is essential that both the modem and the attached device be within the same LAN subnet for IP communication to take place. By default, the modem has a DHCP server running, which will initially assign the following IP address to the attached device (providing the device is set to use DHCP):

	Modem IP	Host IP
Ethernet	192.168.0.1	192.168.0.4
USB	192.168.111.1	192.168.111.20

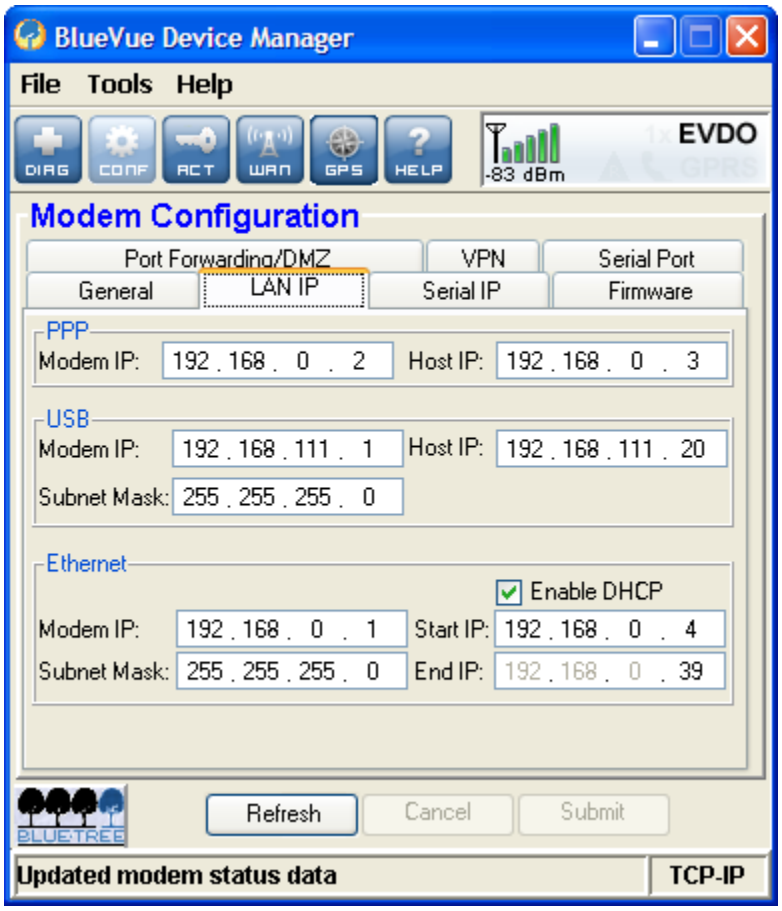


Figure 11

 Copyright © 2007 BlueTree Wireless Data Inc.

If the attached device must use a specific (static) IP, then the modem's LAN configuration must be changed so that the modem's IP lies in the same subnet as the device. Navigate to **CONF (Modem Configuration) > LAN IP** and change the parameters under Ethernet or USB.

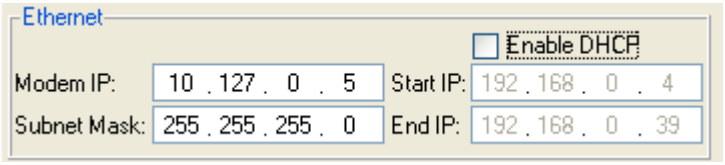


Figure 12 - Sample modem configuration for a device that must use the IP 10.127.0.17

5.1.2 DHCP server

As mentioned above, the modem has a DHCP server which automatically assigns an IP to the attached device. If an Ethernet hub or switch is connected to the modem's Ethernet port, the modem will assign an IP address to each device connected to the hub or switch (Max. 254 devices) provided the devices are set to use DHCP. The DHCP server can be configured or turned off at **CONF (Modem Configuration) > LAN IP** as shown above.

 Copyright © 2007 BlueTree Wireless Data Inc.

5.2 Dial-up Networking (DUN) over serial

- *Regardless of the modem type, using a serial cable will cap the bandwidth at 115200 kbps. For owners of EV-DO modems (4600/A & 5600/A), the serial port will be a bottleneck in terms of performance, as it will reduce the data throughput to approximately 5% of its maximum potential, and even less for EV-DO Rev. A modems. Whenever possible, use an Ethernet or USB connection to take full advantage of throughput.*

Some terminals do not have RJ45 Ethernet or USB connectors and require using a DB9 RS232 standard serial connector to interface with the modem. This section covers programmable devices such as PC or smart (programmable) machinery.

- If the attached device is not programmable, then you cannot do DUN, and will have to use the Serial IP feature to communicate with the device. Refer to Section 7: Serial IP for details.
- If the modem will be used with a programmable device that can make PPP connections, then refer to that device's documentation to create the dial-up session. The phone number to dial will be #777.
- If the modem will be used with a PC, then the user must install a standard modem driver on the COM port to which the modem is physically connected, and then create a dial-up connection running on that driver. This dial-up connection will dial the modem so that a PPP session is established between modem and PC. Meanwhile, the modem will make a PPP session of its own to connect to the network. For a walkthrough on creating a DUN connection in Windows, refer to Appendix D.

 Copyright © 2007 BlueTree Wireless Data Inc.

Section 6: IP Networking Features

As mentioned previously, the modem acquires an external public or private IP address (WAN IP, or Wide Area Network IP) from the cellular network upon establishing a connection. A remote user can communicate with the modem or a host behind the modem, however the appropriate port-forwarding and LAN IP configuration settings have to be set on the modem.

- *Some carriers disable remote access as a security measure. If you are certain that the modem is on the cellular network (i.e., it has acquired a WAN IP) but you cannot reach it remotely, ask the carrier to allow incoming IP data traffic on the required port. Read the Troubleshooting appendix for more details.*

6.1.1 Port-forwarding

Since the 4000/5000 series modem is a network address translation (NAT) enabled router, the remote computer connecting to the modem's cellular WAN IP cannot access devices/servers on the modem's LAN if the modem is not specifically configured to forward the appropriate ports to the LAN devices/servers. Port-forwarding, or tunneling, is the act of relaying an incoming packet to one or more local destinations depending on the port(s) through which the packet came.

The main use of port-forwarding is to allow an external user to reach a port on a private IP address from the outside via a NAT. This allows remote computers to connect to a specific computer within a private LAN, depending on the port used to connect.

To set up the modem's port forwarding rules, navigate to **CONF (Modem Configuration) > Port Forwarding/DMZ**.

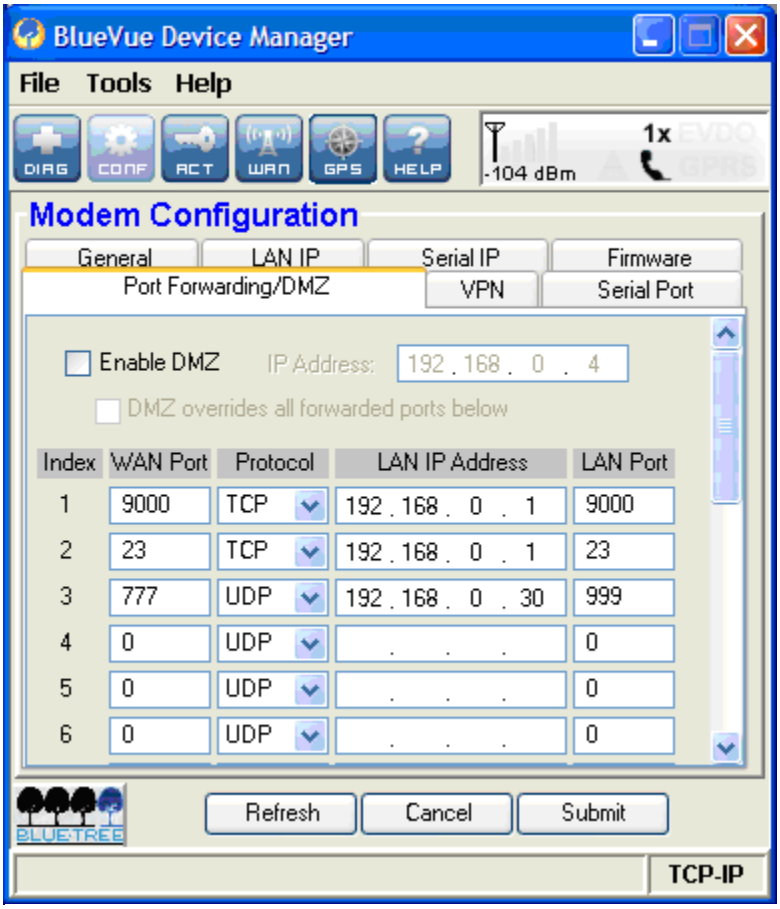

BlueVue Device Manager
File Tools Help
DIAG CONF ACT WAN GPS HELP
-104 dBm
1x
Modem Configuration
General LAN IP Serial IP Firmware
Port Forwarding/DMZ VPN Serial Port
Enable DMZ IP Address: 192 . 168 . 0 . 4
DMZ overrides all forwarded ports below
Index WAN Port Protocol LAN IP Address LAN Port
1 9000 TCP 192 . 168 . 0 . 1 9000
2 23 TCP 192 . 168 . 0 . 1 23
3 777 UDP 192 . 168 . 0 . 30 999
4 0 UDP 0
5 0 UDP 0
6 0 UDP 0
Refresh Cancel Submit
TCP-IP

Figure 13

The WAN Port is the destination port number used by the remote computer and the LAN Port is where the data is forwarded to. Typically the WAN port and LAN port are the same. Select the appropriate protocol (TCP or UDP), and submit the new settings.

6.1.2 DMZ

This feature, when enabled, instructs the modem to forward all incoming traffic to a single IP destination on the LAN. An exception will be made for traffic coming on the ports designated by the port-forwarding rules (this would be ports 9000, 23, and 777 in Figure 13). This exception can be overridden by checking the "DMZ overrides all forwarded ports below" checkbox.

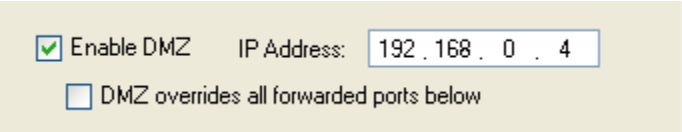


Figure 14

DMZ is ideal in situations where there is already a server on the LAN that handles port-forwarding, as it avoids having to re-program all the port-forwarding rules into the modem. It is also practical when the user does not know which ports his local device listens on, and just wants everything to work with minimal configuration.

DMZ can be enabled at **CONF (Modem Configuration) > Port Forwarding/DMZ**.

6.1.3 IP Pass-through

When this feature is enabled, the modem will disable NAT and assign its WAN IP address to the attached host. The modem will remain reachable though its reserved TCP and UDP ports.

To enable IP pass-through, navigate to **CONF (Modem Configuration) > LAN IP** and select the data interface to perform pass-through on, then check the "Enable IP Pass-through" checkbox.

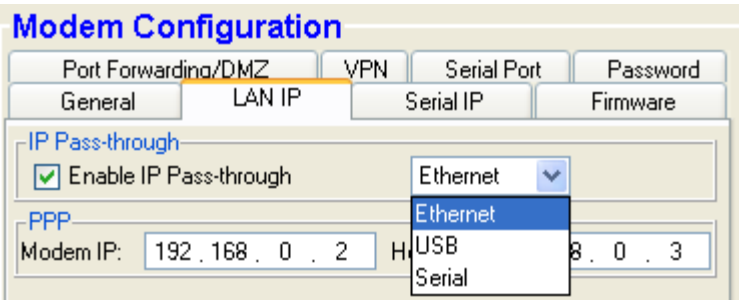


Figure 15

- *If IP pass-through is enabled, then port-forwarding and DMZ should be disabled.*

- *If the host is attached to the modem via an Ethernet cable, then the host must have DHCP enabled (i.e., it should be perform automatic IP negotiation instead of using a pre-defined static IP).*

6.1.4 Dynamic IP registration

This feature allows the modem to report a message to a user-configurable IP address every time its WAN IP address changes.

It is useful when the cellular account is associated with a dynamic IP address. Since the WAN IP address will be changing regularly, it will be impossible for the user to know which WAN IP address is assigned to the modem. With Dynamic IP Registration enabled, the modem will notify a remote server of the new WAN IP address as well as the modem's ESN in hexadecimal format. The IP Registration packet can be sent using either TCP or UDP.

To configure Dynamic IP Registration, navigate to **CONF (Modem Configuration) > General**, and set the destination IP address and port. The registration timer is a value (in minutes) that controls how often the modem should report its IP to the server. If it is set to zero, the modem will report its WAN IP address upon boot-up or upon acquiring a new IP address from the cellular carrier after losing the cellular connection. If it is set to a value between 1 and 65535, then it will report its ESN and WAN IP regularly at the specified interval.

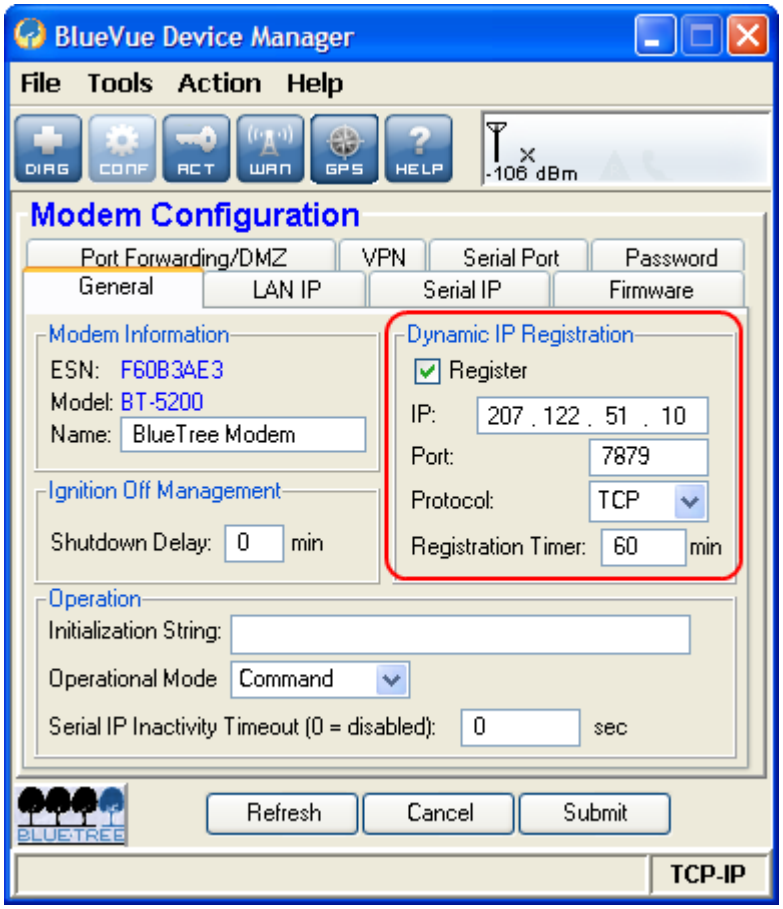


Figure 16

6.1.5 Password protection

This feature allows administrators to restrict configuration access to certain users.

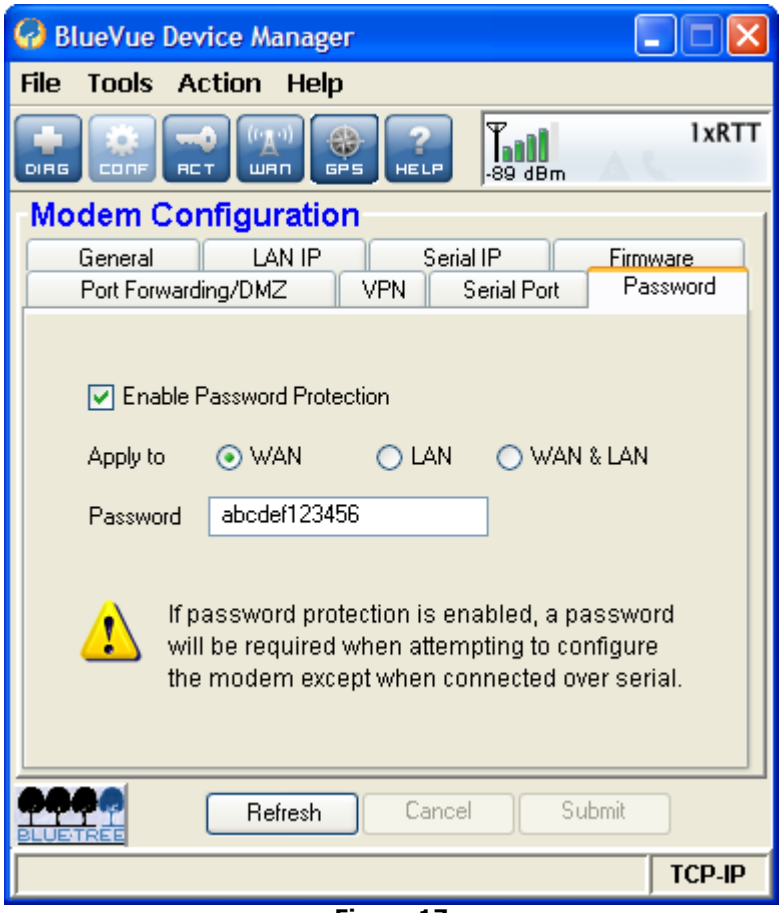


Figure 17

To enable password protection:

1. Navigate to **CONF (Modem Configuration) > Password** and check the "Enable" box.
2. Select the interfaces to prompt for a password on. The WAN interface (remote connections) is the most commonly password-protected interface, however some users may wish to password-protect both the WAN & LAN interfaces. Note that the modem cannot prevent configuration changes made from its serial port.
3. Finally, set the modem password. The password must be a case-sensitive string that is 6-30 characters long.

Section 7: Serial-IP

This feature allows communication over the cellular network in two common setups. The first is a server communicating with a remote serial-only device and the other, a serial-only device communicating with another remote serial-only device. Serial IP is used to emulate a direct serial connection to the attached device, or to emulate a landline modem. The modem then becomes a transparent middleman between the poller and the pollee. Serial IP is most commonly used in telemetry applications such as meter reading and SCADA devices.

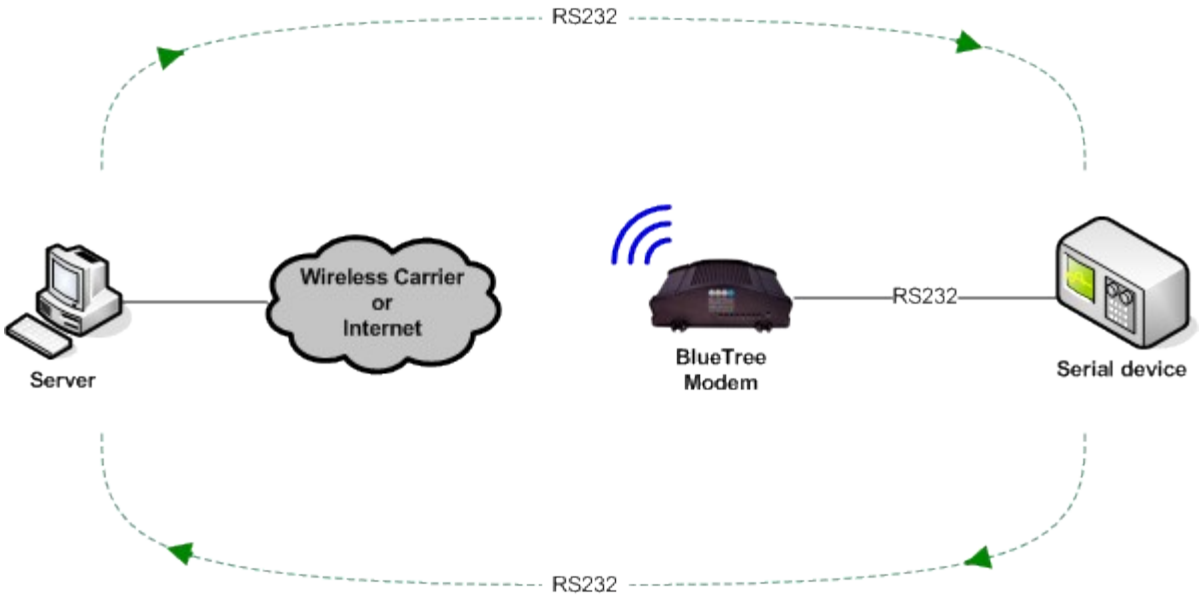


Figure 18

When the modem is in Serial IP mode, IP packets intended for the attached serial device have their IP headers stripped before being passed on to the device. This means that the serial device receives raw serial data that it can understand. Inversely, when the serial device is sending data, the modem encapsulates this data in IP packets to be transmitted over-the-air to the remote destination.

When a Serial IP server is running, the modem waits until a connection is made on the defined Serial IP port, then triggers Serial IP mode. The incoming data will be relayed to the attached serial device. Any output from the serial device will be sent to the IP of the remote computer that made the connection on the port that the remote computer used to make the connection.

When using Serial IP, the modem configuration depends on the application requirements. The four different scenarios are documented in a Support Note (#SN0703121) available at: http://www.bluetreewireless.com/support/downloads/documents/details.asp?id=69

Section 8: I/O Management

BlueTree offers a complete set of AT commands to query/set its general purpose and dedicated input and output pins. This section is only meant to offer a glimpse of how the user can interact with the modem's I/Os.

Refer to Appendix B for basic help on sending AT commands to the modem. For full details on I/O management AT commands, read the *4000 & 5000 Series AT Command Reference* manual, a document available at www.bluetreewireless.com.

The modem's Event Reporting feature (explained in Section 10: Event Reporting) covers I/Os as well. This will allow the automation of some queries and set the modem to report to a local or remote destination when an input value reaches a certain threshold.

Digital Output Control
The three outputs on the modem can be used to toggle peripheral equipment ON or OFF. Peripherals such as lights, sirens, valves, door lock mechanisms, and/or ignitions can be controlled through these I/Os.

Example of turning ON digital output 2:
AT+BDOSET=DO2,1

Digital Input State Query
The modem monitors all of its 4 general purpose digital inputs for a change in state, along with the dedicated ignition input. The state of these inputs can be queried by sending the following AT command:
AT+BDIGET?

Sample response from modem:
+BDIGET: DI1,0
+BDIGET: DI2,0
+BDIGET: DI3,0
+BDIGET: DI4,0
+BDIGET: IGN,1

Analog Input Value Query
The modem has a 10-bit Analog to Digital Converter (ADC) which allows it to monitor all of its 3 general purpose analog inputs for a change in state, along with the dedicated power input. The value of these inputs can be queried by sending the following command:
AT+BAIGET?

Sample response from modem:
+BAIGET: PWR,13.553
+BAIGET: AI1,3.056
+BAIGET: AI2,1.987
+BAIGET: AI3,0.000

Section 9: GPS Settings

- *The modem's GPS reporting frequency determines the cellular network bandwidth consumption. A higher reporting frequency will result in higher bandwidth consumption.*

The 5200 and 5600/A modems have an embedded GPS receiver which can be used to track their movement. This feature is commonly used in applications such as asset-tracking and Automatic Vehicle Location (AVL). These modems support two protocols: the National Marine Electronics Association (NMEA) protocol and the Trimble ASCII Interface Protocol (TAIP).

The modem can report the fixes acquired from its GPS receiver to the local serial port, and/or to an IP address, either local (Ethernet/USB) or remote (over the air). A variety of reporting options are available, ranging from basic NMEA/TAIP timer-based reports to intelligent condition-triggered reports which leverage the modem's Event Reporting capabilities.

TAIP protocol
TAIP is the more complex of the two GPS protocols, allowing greater control over the report contents. It is configured using a single command string. Read Trimble's TAIP documentation to learn to create a command that meets your needs and for report parsing information. The document is available here:
http://www.bluetreewireless.com/extranet/documents/Trimble_ASCII_Interface_Protocol.pdf

The modem listens on UDP port 21000 for TAIP commands, allowing its configuration to be modified on the fly by software applications that support TAIP.

NMEA protocol
NMEA uses one or more of the following seven pre-defined, fixed-format messages.

Message	Contents	Size
GGA	Time, position, and various status information	75 bytes
GLL	Latitude, longitude, and time	48 bytes
GSA	GPS DOP and active satellites	63 bytes
GSV	Active satellites in view	70 bytes
RMC	Time, date, position, course, and speed	67 bytes
VTG	Track made good and ground speed	37 bytes
ZDA	Time and date	35 bytes

Table 9

Refer to Trimble's NMEA 0183 documentation for additional information. It is available here:
http://www.bluetreewireless.com/extranet/documents/NMEA_0183.pdf

Feature: Store & Forward
The 5200 and 5600/A series modems have an integrated 512Kbytes Static RAM memory chip dedicated to storing GPS fixes. It can store approximately 5000 position fixes.

This feature will activate automatically when the WAN connection is lost, such as in the event of loss of cellular coverage. When coverage is regained and communication is re-established with the listening server, the modem will send the buffered fixes to ensure that no positions have been lost.

When Store & Forward is activated, the modem stores GPS data in static memory on a First In First Out (FIFO) basis. This means that if the modem is unable to transmit fixes over an extended period of time, and the memory becomes full as a result, the newest fixes overwrite the oldest stored fixes. When the cellular connection is re-established, or when the TCP socket at the reporting destination is re-established, the modem will send all the stored fixes to the destination.

Stored fixes are not lost when ignition is turned off and the modem is running in low power mode. They are lost only when the modem completely loses power.

Feature: Odometer
The modem can keep track of the total distance traveled by aggregating the data obtained from the GPS fixes. It calculates the distance traveled based on a straight line between the current and previous fix. By appending these calculations to a total, the modem is able to keep track of the total distance travelled. When using the NMEA protocol, the GPS fix is updated every second, so the odometer can be very accurate. However, when using the TAIP protocol, the GPS fix is acquired as per the configured fix acquisition timer. If the timer is set to a high value such as 5 minutes, then the odometer will most likely be inaccurate.

Configuring the modem for GPS reporting
The modem can be configured to report GPS in two ways.

The first is to use BlueVue Device Manager for basic GPS reporting. This allows easy configuration of timer-based GPS reports. Refer to Appendix C for a step-by-step configuration example.

The second is to use AT commands for advanced configuration. This method is more complex and can take advantage of the modem's Event Reporting capabilities (see next section). Event Reporting allows the modem to report automatically when a user-defined condition is met. Read Section 10: Event Reporting for details.

Section 10: Event Reporting

Event Reporting is covered in its own document, the *I/O Management & Event Reporting Guide*, available at www.bluetreewireless.com. This section is meant to provide a general overview of what can be accomplished with Event Reporting.

Event Reporting is used to program the modem to automatically transmit a report whenever a user-defined event occurs to as many as 10 local or remote destinations. An event occurs when its defined conditions have been met.

Events

The event that triggers an automatic report can be any of the following:

- A timer has finished counting down
- An analog input signal has reached a certain value
- A digital input signal has changed state (this includes vehicle ignition monitoring)

The 5200 and 5600/A modems are equipped with a GPS receiver and can react upon these additional GPS-based event triggers:

- The modem is in motion at a particular speed
- The modem is in motion in a particular direction (heading)
- The modem is unable to acquire a GPS fix
- The modem has traveled for a set distance

Events can also be combined using logical statements to create more complex events. For example, a combination of the timer and speed event triggers could define an event that would trigger when a vehicle has been speeding, by defining speeding as moving at 60+ mph for more than 10 seconds.

Reports

Once an event occurs, the modem sends a report to a set destination. All reports, with the exception of one (unformatted GPS reports), are custom-formatted by the BlueTree Event Protocol (BEP) as defined in the *I/O Management & Event Reporting* document, so they require some manipulation on the destination end in order to be parsed.

A report can contain one or more of the following information:

- The modem's name and ESN
- The modem's RSSI (signal strength)
- The value of a specific analog signal
- The state of a specific digital signal
- The modem's odometer value (total distance traveled)
- A BEP-formatted GPS report containing NMEA or TAIP data
- An unformatted GPS report containing NMEA or TAIP data

The modem can be configured to wait for confirmation (“ACK”) from the remote server that it has received the report. If this confirmation does not come, the modem will assume the report has not been received and will continue sending the same report at a configured interval until it receives confirmation of receipt.

To ease the parsing of the packets on the server, the modem can sync flags in the beginning and end of each packet it sends.

Section 11: Hardware Installation

11.1 Cellular antenna

The selected cellular antenna(s) must meet the following specifications:

- Maximum rated gain of 3dBi for Cellular band and 4dBi for PCS band
- Dual-band 800 & 1900 MHz
- Nominal 50 ohm impedance
- Voltage Standing Wave Ratio (VSWR) less then 2.5:1
- Connector:
  - Male SMA connector for 4600/A & 5600/A modems
  - Male TNC connector for 4200 & 5200 modems

The length of the antenna cable may affect the signal strength. Choose the appropriate cable type and length. The table below provides can help pre-determine the loss to expect.

Cable type	Loss per 100 feet
8216 (RG58)	31 dB
8267 (RG213)	7.6 dB
LMR-400	3.9 dB
LMR-500	3.15 dB
LMR-600	2.5 dB
LMR-1200	1.26 dB

Table 10

Installation and verification

When installing the antenna, follow the FCC and Industry Canada guidelines and keep the following in mind:

- Mount the antenna(s) at least 30 cm (12 inches) from other antennas
- Do not install the antenna in a closed metallic enclosure (such as a cabinet or the trunk of a car).

Once a modem has a signal, the REG LED indicator will start flashing, indicating that the modem is registered on the cellular network (i.e. within coverage). Additionally, BlueVue Device Manager will display the received signal strength (RSSI) in the top right. The modem should have at the very least one bar of signal strength.

11.2 Antenna diversity

The 4600/A & 5600/A modems have two antenna connectors available, labeled RF-1 and RF-2.

- RF-1 : This is the main antenna that is used for data transmission. It is mandatory to have RF-1 connected to an antenna.
- RF-2 : This is the diversity antenna, used to improve on the signal strength obtained from RF-1. This antenna is not mandatory however it can improve reception in some situations.

Diversity is a transmission technique that consists of using two separate antennas to achieve the best cellular signal possible. The transmissions will be done using the antenna which has the best reception. Diversity is particularly useful in mobile environments.

The diversity antenna should be placed with these recommendations in mind for optimal use:

- The minimum distance between the main antenna and the diversity antenna should be 9".
- The recommended minimum distance between main antenna and the diversity antenna is 18".
- If it is possible to increase the distance between the two antennas, use increments of 9", such as 27", 36", 45", etc.

11.3 GPS antenna

The 5200 & 5600/A modems have an additional SMA connector for the GPS antenna. The selected GPS antenna must meet the following specifications:

- Active antenna with 3.3 volts preamplifier
- Nominal 50 Ohms impedance
- Male SMA connector
- Frequency band: 1575 MHz

When installing the GPS antenna, make sure it has line-of-sight with the sky. Then connect the cable’s connector into the modem’s GPS connector by screwing it in tightly by hand.

To test the installation, look at the GPS LED at the front of the modem. It will start flashing once a fix has been acquired. After the antenna is installed, allow a couple of minutes before a fix is acquired, as it can take up to three minutes for the modem to synchronize with the available GPS satellites.

11.4 Ethernet cable

If you are connecting to the modem via the Ethernet port, you will need a crossover category 5 cable with two 8-pin RJ45 connectors on each end.

To visually confirm that Ethernet cabling was done properly, check the LED indication on the Ethernet port located at the rear panel of the modem. The Link LED should be on when the right cable is used.

11.5 USB cable

This is an Ethernet-over-USB connection which behaves like an Ethernet connection. If you are connecting to the modem via the USB port, you will need a TypeA/TypeB male USB cable. You will also need to install the BlueTree USB driver which is available at www.bluetreewireless.com.

11.6 Serial cable

The modem has all its serial port pins enabled. If all the pins are enabled on the attached serial device, it is important to know whether the device is using DTE or DCE as a communication mode.

The modem is a DCE device, so use a straight-through serial cable between the modem and a DTE device such as a terminal. Use a NULL modem cable adapter between the modem and a DCE device such as another modem.

If using custom wiring or if some pins are disabled, follow the guidelines below. The wiring will vary depending on whether the attached serial device is a DTE or DCE.

Modem		DTE
CTS	←→	CTS
RTS	←→	RTS
DTR	←→	DTR
DSR	←→	DSR
TX	←→	TX
RX	←→	RX
DCD	←→	DCD
GND	←→	GND
RI	←→	RI

Modem		DCE
CTS	←→	RTS
RTS	←→	CTS
DTR	←→	DSR
DSR	←→	DTR
TX	←→	RX
RX	←→	TX
DCD	←→	DCD
GND	←→	GND
RI	←→	RI

11.7 Power source

- ***IMPORTANT:*** *Any installations involving electrical wiring and connections should be done by someone who is experienced in this field.*

To power the modem, a 12 VDC nominal power (8Vdc to 30Vdc) source is required. Further details are available in Section 2.3.

The modem package includes a 15-foot power cable with 2A in-line fuse with, on one end, a 4-pin Molex MiniFit connector that connects to the modem, and stripped wires on the other end to connect to your power source.

Figure 19

The ignition sense line (white wire) acts as an ON/OFF power switch. The modem will turn on when the ignition sense line is set between 8 and 30 volts DC. The modem will turn off if the ignition sense line is less than 5 volts DC.

Pin designations for the connector are shown in Figure 20.

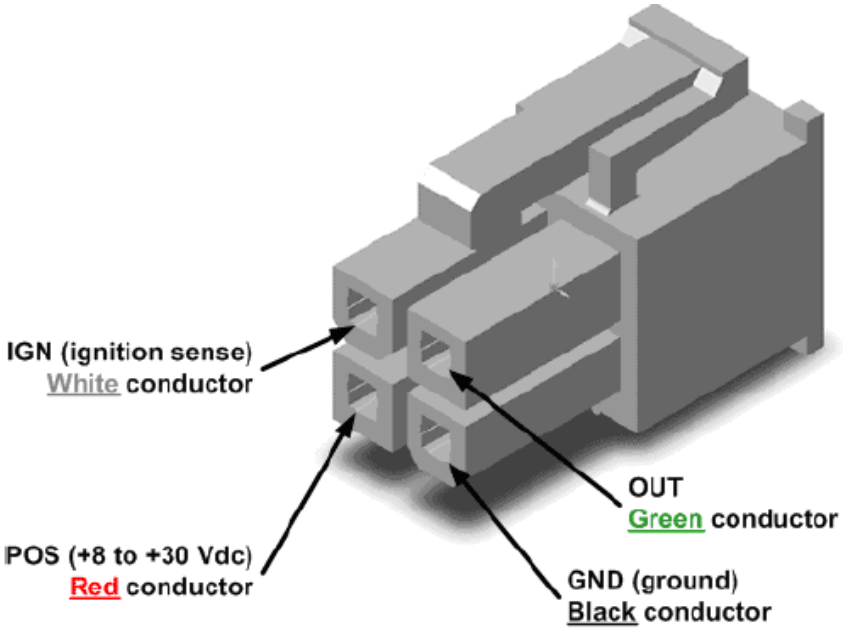


Figure 20

11.7.1 Powering up the modem

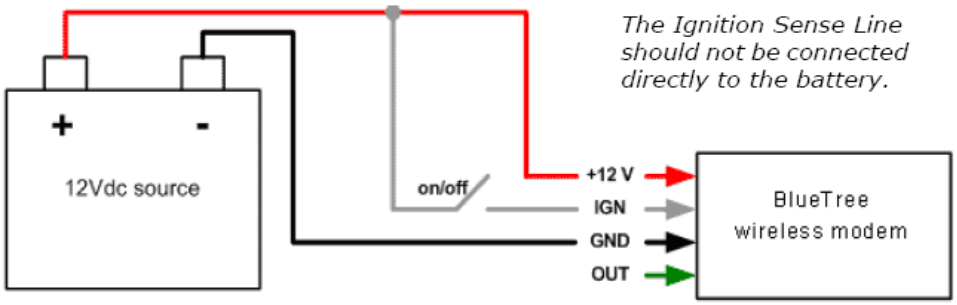


Figure 21

- Connect the red wire directly to the battery's positive (+) terminal or to a source of 8-to-30Vdc
- Connect the black wire directly to the battery's negative (-) terminal or to ground (GND)
- The white wire must be connected to either:
    - The red wire to keep the modem powered on when there is power
    - A switch for manually turning on and off the modem
    - The vehicle's "Accessory for position 2", for turning ON the modem without turning on the engine
    - The vehicle's "Accessory for position 3", for turning ON the modem only when the engine is turned on.

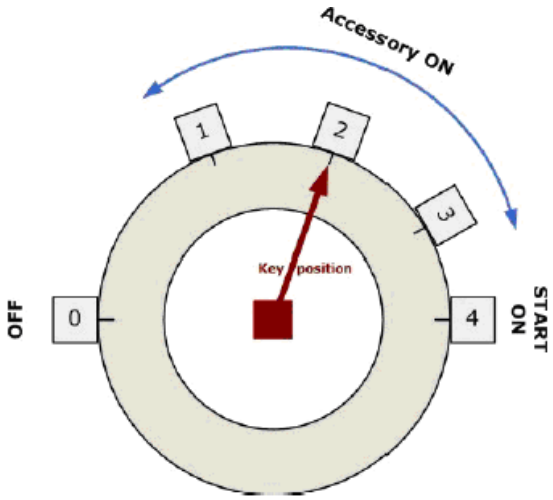


Figure 22

11.7.2 Testing the power connection

Check the PWR light on the modem: if it is turned on then the modem is powered. If it's off, then review the installation procedures.
If LED indicators are not accessible to the installer a personal computer can be used to verify it's functionality by running BlueVue Device Manager and attempt to connect to the modem.

11.8 I/O Cable Wiring

The I/O specifications are available in the Product Overview section of this document.

It should be noted that the I/Os of the modem are not insulated. Caution must be used in order to avoid causing damage to the modem and its attached peripherals.

The 15-foot 10-pin I/O cable is available for purchase from BlueTree.
The Molex plug shown in the figure below is found at one end of the cable, and stripped wires are found at the other end for easy connection to your equipment or sensors.

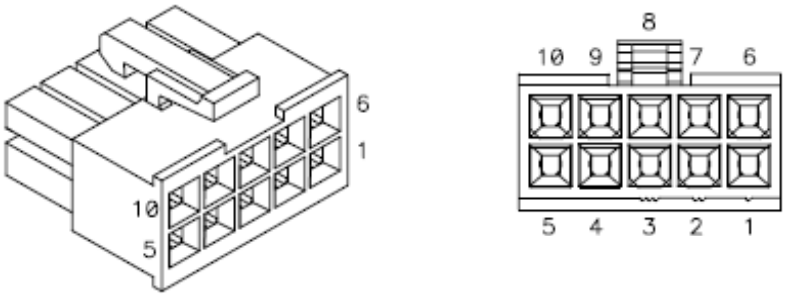


Figure 23

Pin	Color	Label	Description
1	BLUE	DI3	Digital Input #3
2	ORANGE	DI1	Digital Input #1
3	GREEN	O1	Digital Output #1
4	BROWN	AI3 (4600/5600 only)	Analog Input #3
5	GRAY	AI1	Analog Input #1
6	VIOLET	DI4	Digital Input #4
7	YELLOW	DI2	Digital Input #2
8	RED	O2	Digital Output #2
9	BLACK	GND	GROUND
10	WHITE	AI2	Analog Input #2

Table 11

The I/O port on the BT-4000 and 5000 series is designed to allow for a variety of uses, including:

- connecting a panic button or a passive on/off sensor
- connecting an active voltage source
- turning on and off an external peripheral
- connecting an analog gauge or source (0-5Vdc) (4-20mA)

11.8.1 Connecting a panic button or a passive on/off sensor to the modem's digital input:

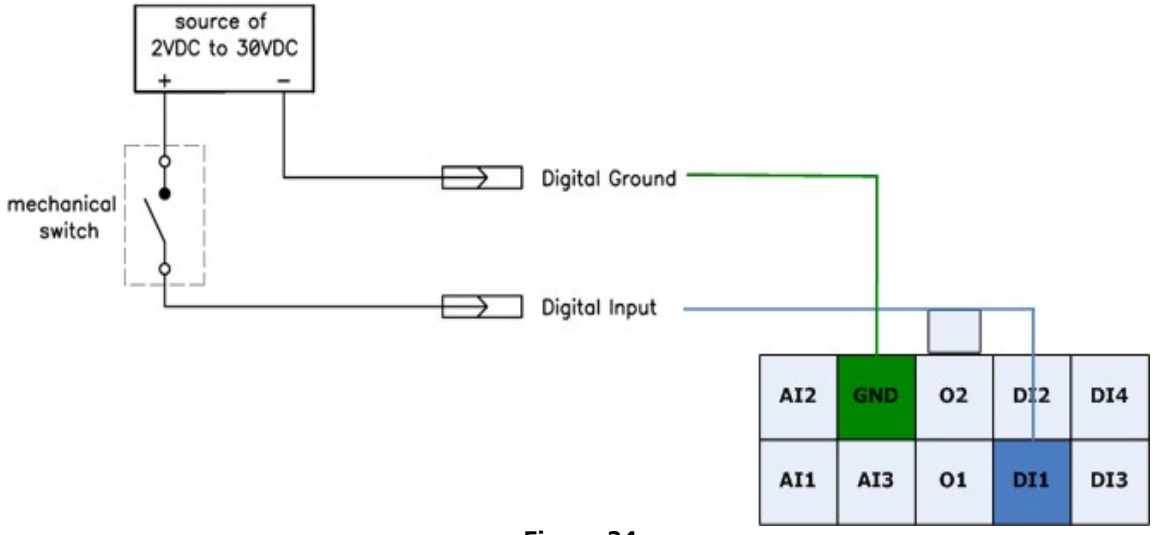


Figure 24

1. Connect the negative side of the voltage source to the Ground pin (GND).
2. Connect the first wire of the panic button, or the passive on/off sensor, to one of the 4 digital inputs.
3. Connect the second wire to the positive of a power source (2VDC - 30VDC).

11.8.2 Connecting an active voltage source to the modem's digital input:

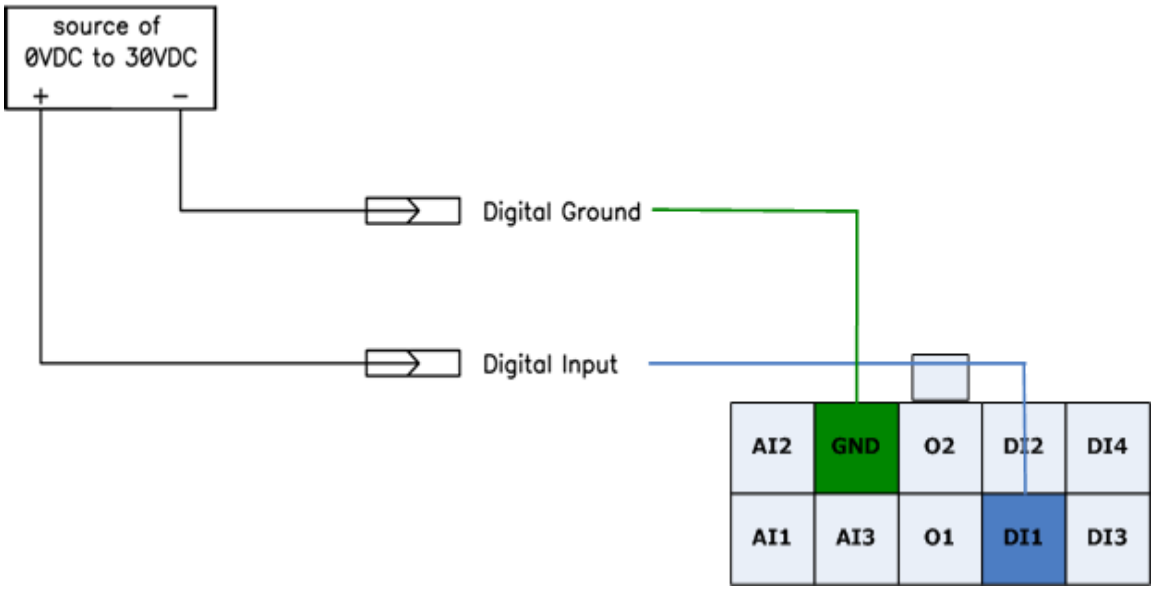


Figure 25

1. Connect the negative side of the voltage source to GND.
2. Connect the positive side (0VDC - 30VDC) of the voltage source to one of the 4 digital inputs.
3. Check the polarity of the source before connecting it to the I/O connector.

11.8.3 Turning on and off an external peripheral using a power relay on the modem's digital output:

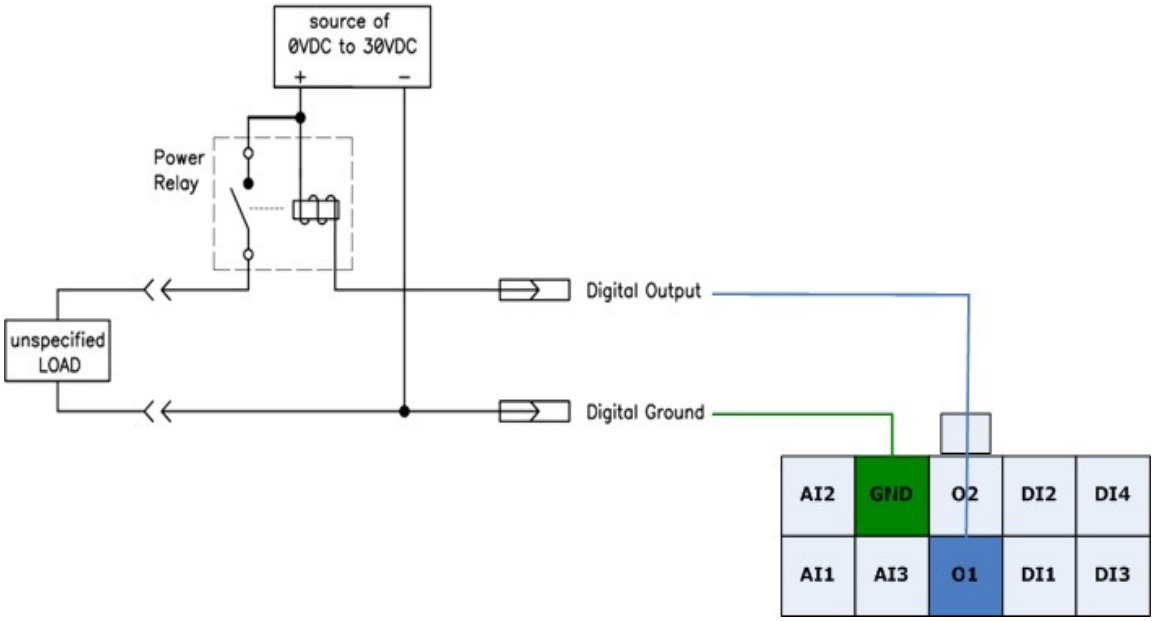


Figure 26

1. Connect the positive side of the relay to a positive power source (Max. 30VDC) that corresponds to the specifications of the relay used.
2. Connect the negative side of the relay to one of the 3 digital outputs (Max. current 500mADC).

11.8.4 Connecting an analog gauge or source (0-5Vdc) to the modem's analog input:

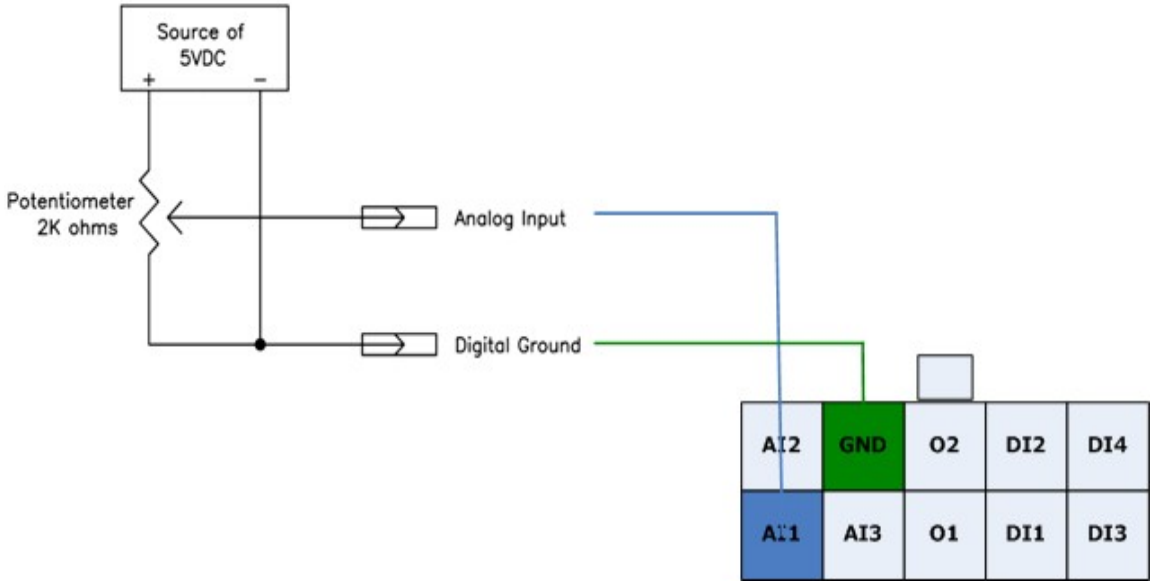


Figure 27

1. Connect the negative side of the analog source to GND.
2. Connect the positive side of the analog source (0VDC - 5VDC) to one of the 2 digital inputs.
3. These analog inputs are not designed to detect a signal at high speed. This approach was adopted to minimize the errors which could be caused by the noise of high frequencies captured by wiring. The detection of a DC source with a slow variation will not cause any problems.

11.8.5 Connecting an analog gauge or source (4-20mA) to the modem's analog input:

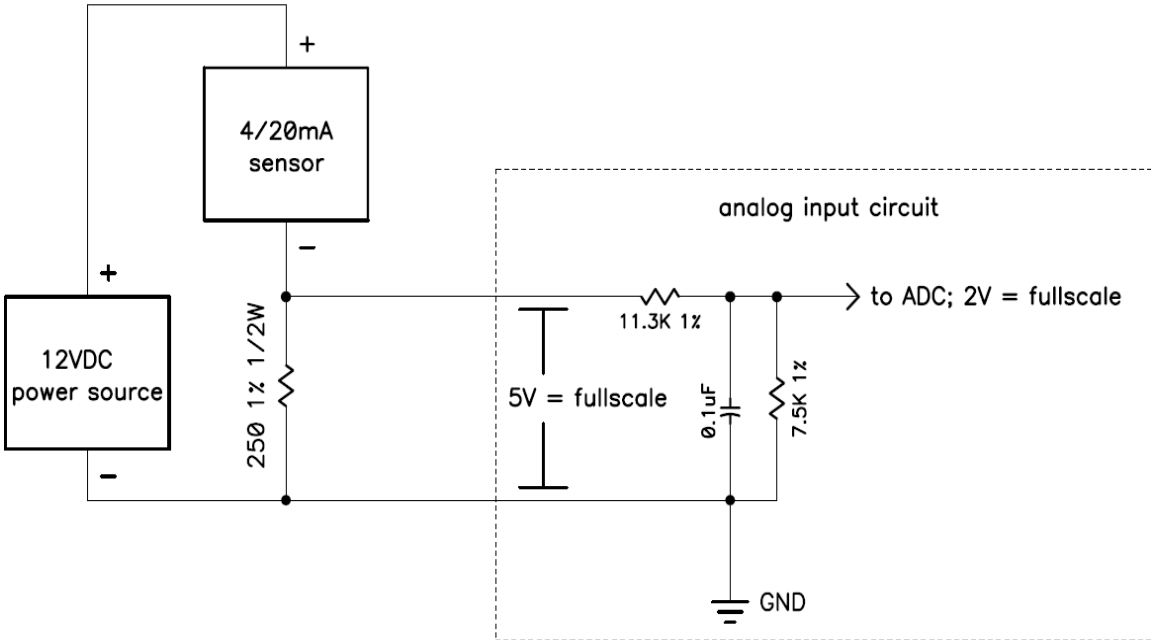


Figure 28

Follow the above diagram to convert a 4-20mA source into a 0-5Vdc input to the modem's analog input (ADC). 249 and 255 ohms are standard values for a 1% resistor.

Readings:

- At 20mA, the modem reads around 5V on the analog pin
- At 4mA, the modem reads around 1V
- When the current loop is missing, the modem reads 0V

11.9 Mounting the modem

The modem requires four #4 screws (3/16") pan or fillister head, as well as corresponding lock washers.

Appendix A : Firmware Upgrades

BlueTree periodically releases updates to the BlueX firmware used on the 4000/5000 modems. These updates improve the modem's stability and functionality by addressing bugs and introducing new features. It is recommended to always upgrade to the latest version of the firmware.

Firmware upgrades can only be performed if BlueVue Device Manager is accessing the modem through an IP connection such as a local Ethernet, USB connection or a remote connection over the Internet. It is not possible to update the firmware using a serial cable.

To upgrade a modem remotely over the air, it must have a static IP account with the cellular carrier. If the modem has a dynamic IP (i.e. if its IP changes regularly), and the IP is changed when the modem resets during the firmware update procedure, then BlueVue Device Manager will not be able to reconnect and finalize the update, and the modem will revert back to its previous firmware the next time it is reset. If you are able to connect to the modem, send the AT command "AT+BFWUPS=0" to finalize the upgrade and prevent the modem from reverting back on the next reset. To learn how to send an AT commands, read Appendix B.

1. Ensure that the modem is at a 3.x firmware version

It is not possible to upgrade a modem from firmware versions 1.x or 2.x to 3.x by following the steps below. They are intended for modems that are upgrading from a 3.x release to a more recent 3.x release. Modems with older firmware such as 1.x or 2.x require an advanced firmware upgrade. Download the latest Advanced firmware upgrade package from www.bluetreewireless.com and follow the instructions contained within.

You can **check your modem's firmware** using BlueVue Device Manager under **CONF (Modem Configuration) > Firmware**:

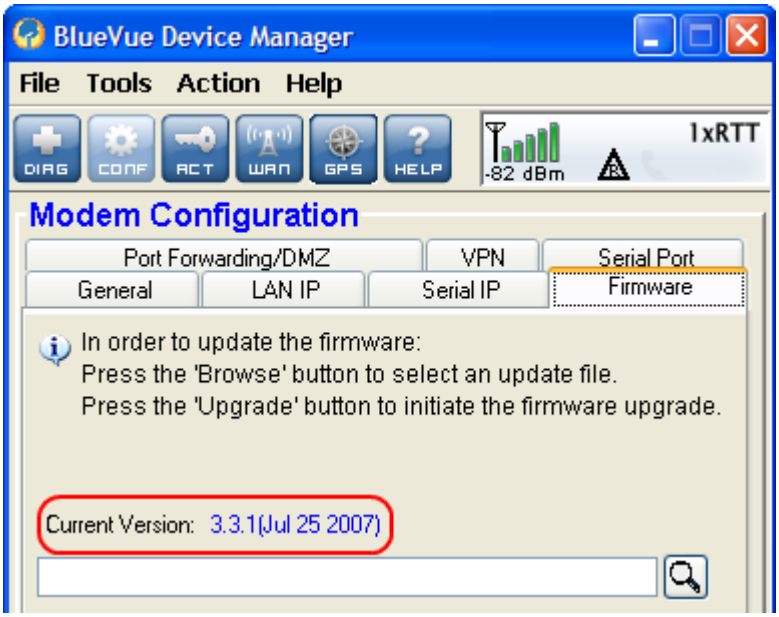


Figure 29

2. Download the firmware files

Download the latest standard **firmware package files** from www.bluetreewireless.com, and extract the zip file to a folder on your hard drive. It should contain a file named **abt_version.upd** and a file named **kbt_version.upd** as well as a document containing the same upgrade instructions as this appendix.

3. Perform the abt firmware upgrade

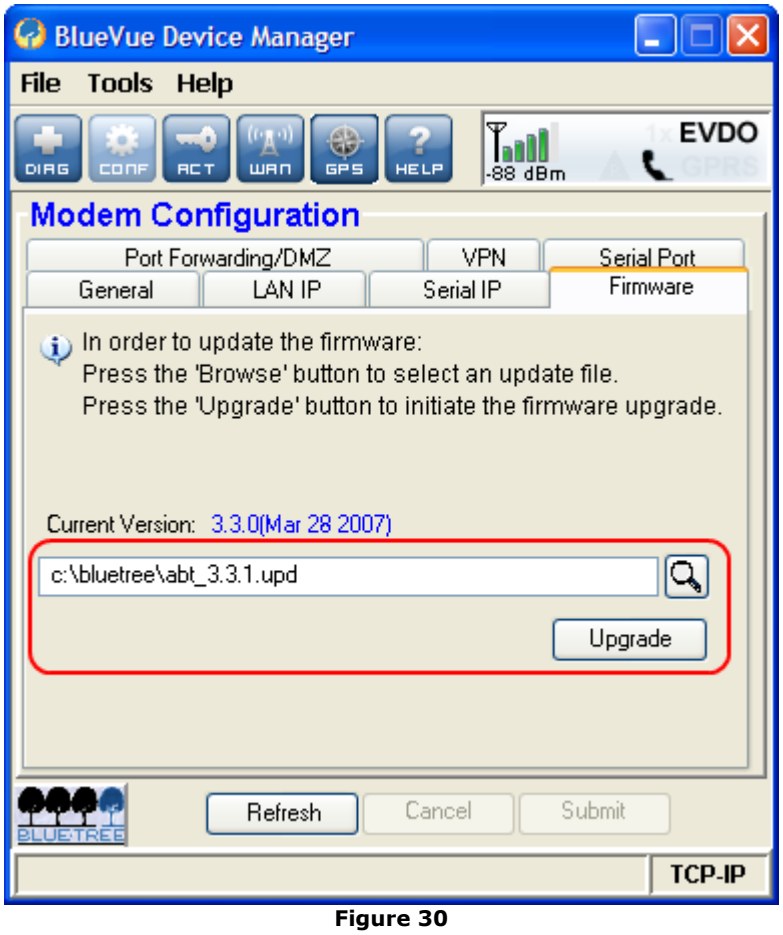


Figure 30

1. Navigate to **CONF (Modem Configuration) > Firmware**.
2. Click the magnifying glass icon and **locate the abt_version.upd file** from the package that you extracted at step 1.
3. Click **Upgrade**.
4. **Wait** for BlueVue Device Manager to confirm that the firmware update was completed. If the upgrade is being performed locally, it should approximately take 2 minutes. If it the upgrade is being performed remotely, then it could take up to 5 minutes depending on upload speed.

4. Perform the kbt firmware upgrade

The steps to upgrade the kbt firmware are identical to those of the abt firmware, however they are rarely necessary as kbt updates are few and far between. To check whether the modem requires a kbt upgrade, navigate to **DIAG (Modem Diagnostic)**, and look under modem version for the portion highlighted below.

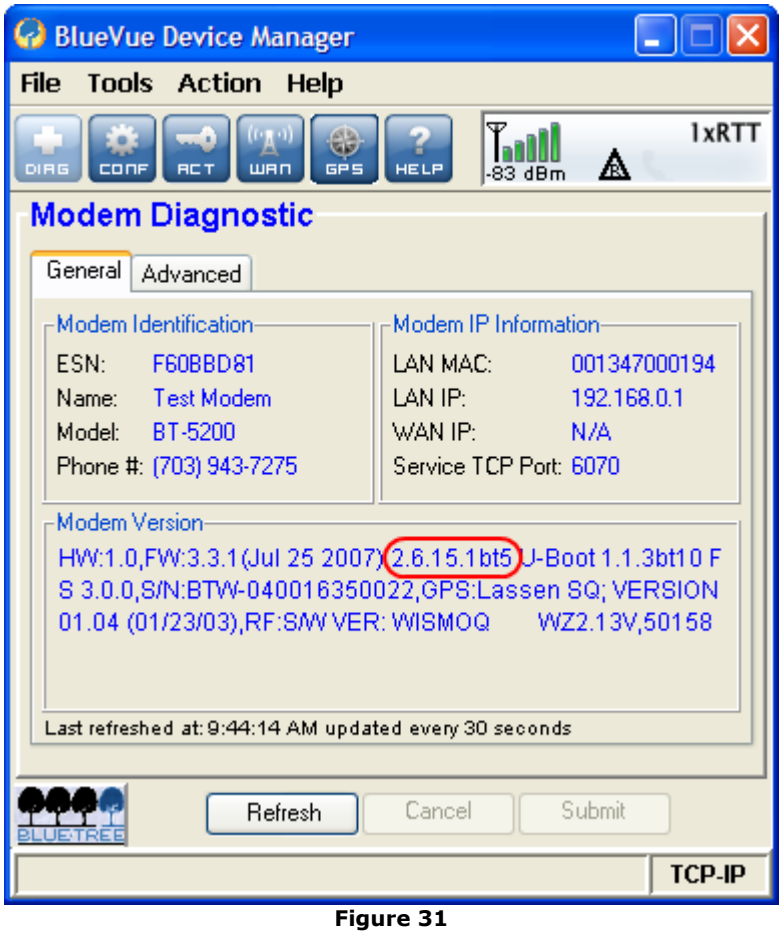


Figure 31

If the version of the kbt file you downloaded is identical to the version displayed in the modem information box, then the kbt upgrade is not necessary. However, if the version downloaded is more recent (i.e., it has a higher version number) than the version displayed, then the kbt firmware must be upgraded.

The steps to upgrade the kbt are identical to those of the abt file. Click the magnifying glass icon and locate the kbt_version.upd file from the package that you extracted at step 1, and then click Upgrade.

Your modem should now be at the latest firmware version. Confirm the change as shown in step 1.

Appendix B : Sending AT Commands

AT commands are short text strings that can be sent to the modem to set, remove and query a modem's configuration parameters. BlueVue Device Manager is a software application that provides a graphical user interface designed to avoid manual entry of AT commands. However, not all configuration commands are available in BlueVue. Additionally, BVDM is only available in Microsoft Windows operating systems. For these and various other reasons, some users may want to send AT commands to the modem.

The full list of AT commands and their description is in the *4000 & 5000 Series AT Command Reference* manual, available at www.bluetreewireless.com.

- ***IMPORTANT:*** *After sending AT commands to configure the modem, you must send* ***AT&W*** *to save the changes. Otherwise, they will be lost the next time the modem resets. You do not need to send AT&W after each command, you can send it just once when you're done configuring the modem.*

Sending AT commands over an IP connection

If you can reach the modem using a crossover Ethernet cable, or a USB cable, or remotely to the modem's WAN IP, AT commands can be sent by performing a TCP (telnet) connection to the modem on port 6070. Here is an easy way to do this in Windows:

1. Click the **Start** button, then **Run**.
2. In the Run window, type **command** and click OK. A command prompt window will open.
3. Type **telnet xxx.xxx.xxx.xxx 6070** (replacing the x's with the modem's IP) and press **Enter**. By default, the modem's IP will be 192.168.0.1 for Ethernet, and 192.168.111.1 for USB. If connecting to a remote modem, you will need to know its WAN IP.
4. You should get a "Welcome to BlueTree Wireless" message. You can now **send AT commands**.

Sending AT commands over a serial connection

If connected to the modem using a straight DB9 serial cable, AT commands can be sent using a terminal emulation software. The terminal and the modem must be using identical serial port settings to communicate. By default, the modem uses 115200 bps, 8 data bits, no parity, 1 stop bit, and hardware flow control. Below is an example for connecting to a modem with default serial port settings.

1. Open **HyperTerminal**. To do so, click the **Start** button and then click on **Run**. In the Run window, enter **hypertrm** and click **OK**.
2. On the **Connection Description screen**, enter **any** name, select any icon, and then click OK.
3. On the **Connect To screen**, change the **Connect using** value to the **COM port** the modem is connected to and click OK.
4. On the **COM Properties screen**, change the **Bits per second** value to **115200**, leave all the other options untouched (8, None, 1, Hardware), and click OK.

You should now be able to send AT commands. You will not see what you type until you send the command ATE1 or enable echo in HyperTerminal's settings, but the commands will still be sent to the modem. Send ATI and confirm that you see the words “BlueTree Wireless” in the response.

Appendix C : Basic GPS Reporting in BlueVue Device Manager

- *The modem's GPS reporting frequency determines the cellular network bandwidth consumption. A higher reporting frequency (i.e., a low reporting timer value) will result in higher bandwidth use.*

This appendix shows how to use BlueVue Device Manager to configure the modem for basic GPS reporting. For more complex and/or automatic reports, read Section 10: Event Reporting.

These GPS reports will be unformatted TAIP or NMEA data that can be interpreted by any application written with one of these standards in mind. For example, the Microsoft's Streets & Trips can interpret the modem's GPS output if the modem is using the NMEA protocol.

To **configure GPS** reporting, navigate to **CONF (Modem Configuration) > GPS**. You will now have to select a protocol and set a destination for the reports. Note that if the TAIP protocol is selected, reporting will not begin until the modem has acquired a valid GPS fix.

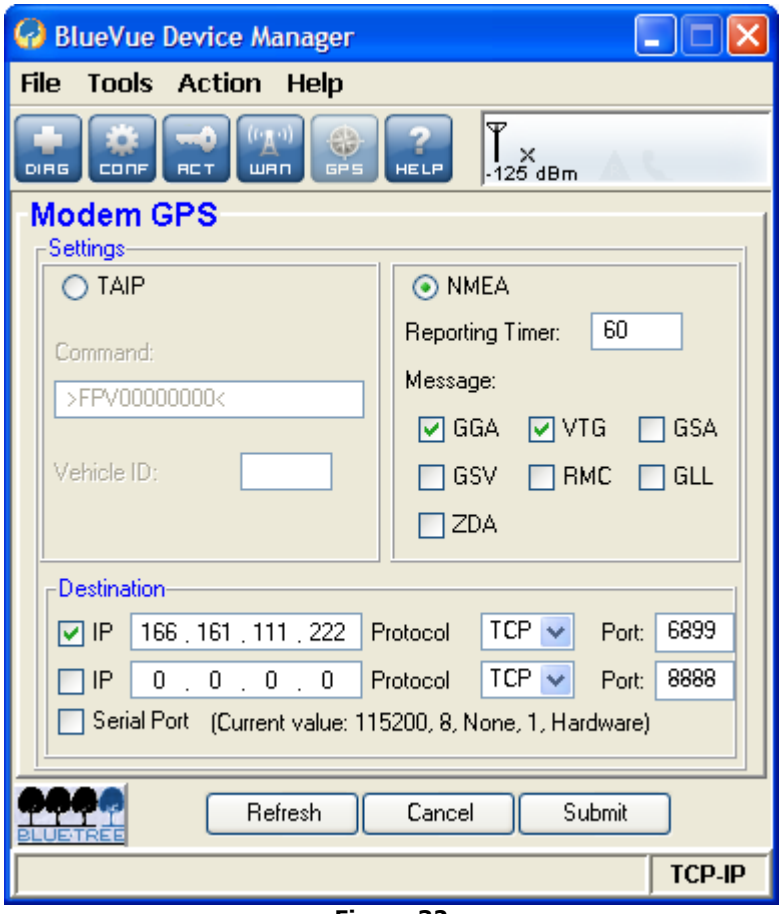


Figure 32

- *When the modem has not acquired a GPS fix, the reporting behavior is different depending on the protocol. if using NMEA, then the modem will report empty fixes. If using TAIP, then the modem will not send any reports.*

1a. Using the NMEA protocol

Read Section 9: GPS Settings for details on NMEA.

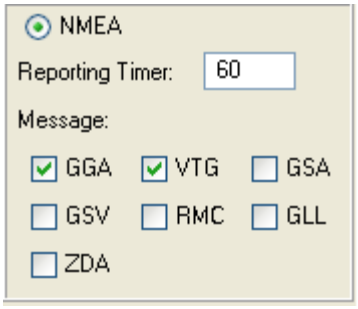


Figure 33

1. **Set the reporting timer** (in seconds). This timer is the interval at which the modem will report its GPS position fix.
2. **Select the NMEA message**(s) to report
3. Click **Submit**

1b. Using the TAIP protocol

Read Section 9: GPS Settings for details on TAIP.

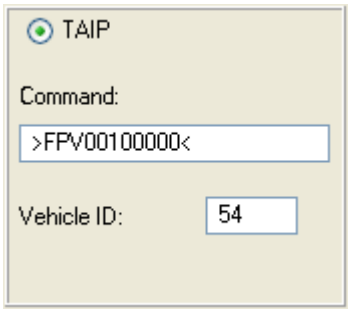


Figure 34

1. **Enter the TAIP command** that will be used. The command shown in Figure 34 acquires and reports its position, time and velocity every 10 seconds.
2. Optionally, enter an identifier ("Vehicle ID") to be reported alongside the fixes
3. Click **Submit**

2. Setting a destination

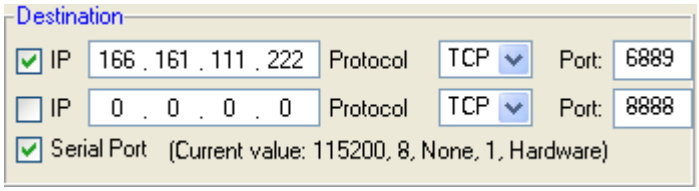


Figure 35

BlueVue Device Manager allows you to send GPS reports to the serial port and/or up to two IP destinations. Check the appropriate destination checkboxes. For IP destinations, select the IP address to report to, the port protocol, and the port number. When done, click Submit to save the changes.

If using NMEA, the reports will start coming in immediately (although if there is no fix, the reports will be empty). If using TAIP, the reports will not come in until there is a valid fix.

Appendix D : Dial-Up Networking in Windows

This appendix shows how to create a dial-up networking session to access the Internet/cellular network when connected to the modem using a serial cable. Although these instructions are written for computers running Microsoft Windows XP, this procedure should be similar with other versions of Microsoft Windows.

Installing a modem driver

1. Click **Start > Run**, type **control modem.cpl** and then click **OK** to open the Phone and Modem Options panel
2. Click the **Modems tab** and then click **Add**
3. You may be required to enter location information if this is the first modem installed. If this is the case, choose your region and area code in the information window.
4. Check the box labeled **Don't detect my modem...** and then click **Next**
5. Select **Standard 33600 bps Modem** from the list and click **Next**
6. Select the **COM port** that the modem is attached to then click **Next**
7. Click **Finish** to complete the driver installation

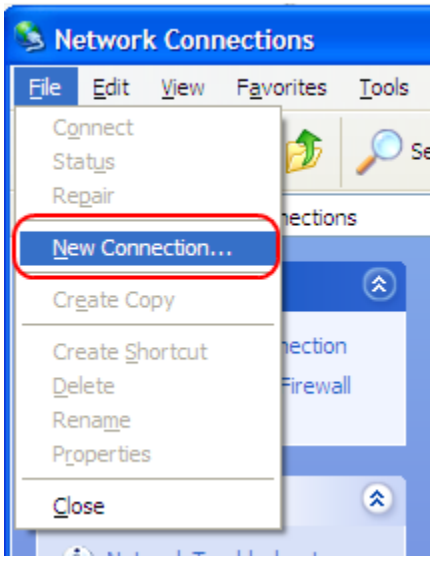


Figure 36

Creating a Dial-Up Networking session

1. Click **Start > Run**, type **control ncpa.cpl** and then click **OK** to open the Network Connections panel.
2. Click on **File > New Connection** (as per the screenshot above)
3. The New Connection Wizard welcome dialogue will appear. Click **Next**.
4. The Network Connection Type dialogue will appear. Select **Connect to the Internet** and click **Next**.
5. The Getting Ready dialogue will appear. Select **Set up my connection manually** and click **Next**. Name the connection in the new window.
6. The Internet Connection dialogue will appear. Select **Connect to a dialup modem** and click **Next**.
7. **If there is more than one modem installed in Windows**, the Select a Device dialogue will appear. If this is the case, select **Standard 33600bps Modem** and click **Next**. Otherwise, proceed to the next step.
8. The Connection Name dialogue will appear. Type in **any name** for the connection and click **Next**.
9. The Phone Number To Dial dialogue will appear. Enter **#777**.
10. The Internet Account Information box will appear. Enter the **username and password associated with the account** in the corresponding fields and click **Next**.

The DUN connection is now set up, and your PC is ready to connect to the cellular network. Right-click your new connection in the Network Connections list, and click Connect.

Once the connection has been established, the modem will by default assign the attached device the LAN IP 192.168.0.3, while the modem itself will have the LAN IP 192.168.0.2. These settings are configurable in BlueVue Device Manager under **CONF (Modem Configuration) > LAN IP > PPP**.

Appendix E : BlueVue Device Manager Troubleshooting

- *Before troubleshooting, download and install the latest version of BlueVue Device Manager and upgrade the modem's firmware to the latest version if possible.*

1. (ETHERNET) The BlueVue Device Manager message box displays "Detecting Modem at 192.168.0.1" indefinitely

Connect the modem to a computer using a cross-over Ethernet cable, and open BlueVue Device Manager. Set BlueVue Device Manager's connection type to IP. BlueVue Device Manager will attempt to connect to 192.168.0.1 by default.

Possible cause #1:

The wrong type of cable is being used.

Troubleshooting:

Check the Link LED on the modem's Ethernet connector (located on the back of the modem). If the LED is off, check the cable type. A **cross-over** RJ-45 Ethernet cable is required for communication between the modem and the PC. A standard Ethernet cable won't do.

Possible cause #2:

The computer's local IP configuration is incorrect.

Troubleshooting:

1. In Windows XP, go to **Control Panel > Network Connections** and select the **local area connection** that corresponds to the Ethernet port in the "LAN or High-Speed Internet" list (it's usually "Local Area Connection 1").
2. Right-click the connection and click **Properties**. Select **Internet Protocol (TCP/IP)** in the list and click **Properties**.
3. Write down the existing values in order to restore them after configuring the modem, then select **Obtain an IP address automatically** and **Obtain DNS server address automatically**. The computer will now be ready to use the modem to access the Internet.

Possible cause #3:

The modem is in a different network and DHCP is disabled. (This issue does not apply to brand-new modems at factory settings. It only applies to modems that have had their configuration modified.)

Troubleshooting:

The easiest way is to perform a firmware recovery. This resets the modem's configuration to its default settings, which will restore the default modem IP and enable DHCP. The firmware recovery package is available at www.bluetreewireless.com.

If you wish to attempt to recover the modem without performing a firmware recovery, then you can follow the instructions below:

1. Connect the computer to the modem using a straight **serial cable**
2. Set BlueVue Device Manager to **connect to the modem** over the serial port by changing the connection type to Serial
3. Once the modem has been accessed, navigate to **CONF (Modem Configuration) > LAN IP**
4. Under Ethernet, confirm that the Modem IP is set to **192.168.0.1**
5. Confirm that **DHCP is enabled** and that the **DHCP Start IP** is **192.168.0.4**. Set the End IP range to any value higher than 192.168.0.4. The default is 192.168.0.39.
6. Click **Submit** to save the changes
7. Reset the modem and restart the computer

2. (USB) The BlueVue Device Manager message box displays "Detecting Modem at 192.168.111.1" indefinitely

Possible cause #1:

The USB driver is not installed.

Troubleshooting:

The **USB driver** for Windows must be installed before the modem's USB functionality can be used. Visit www.bluetreewireless.com to download the USB driver then install it. It may be necessary to reboot the computer.

Possible cause #2:

The modem has an old firmware version which does not support USB.

Troubleshooting:

The USB functionality was introduced in version 3.0 of the firmware. **Upgrade the modem's firmware** to the latest version available at www.bluetreewireless.com. See Appendix A for details.

3. (SERIAL) The BlueVue Device Manager message box displays "COMx is already in use"

Possible cause:
Another software application is already using the COM port.

Troubleshooting:
Close all applications that could be using the serial port, including other instances of BlueVue Device Manager, then try again.

4. (SERIAL) The BlueVue Device Manager message box displays "Detecting modem on COMx" indefinitely, or displays a warning about an unsupported modem

Examine the DTR LED. If it is off, then the computer and the modem are not communicating.

Possible cause:
The wrong type of cable is being used.

Troubleshooting:
Use a straight-through RS232 standard DB9 cable. If using a custom-made cable, confirm that it follows the instructions in Section 11.6. If the **correct cable** is being used, then the **DTR LED** on the modem will **turn on** when BlueVue Device Manager attempts to access it.

Possible cause:
BlueVue Device Manager is trying to connect to the wrong COM port.

Troubleshooting:
Confirm that the **correct COM port** is selected in BlueVue Device Manager. It will attempt to use COM1 by default, but computers with built-in dial-up modems might have COM1 assigned to the built-in modem instead. To set the COM port BlueVue Device Manager should use, click on **Tools > Settings > Connection** and browse through the available COM ports. If the **DTR LED turns on**, then you will have found the right COM port.

5. (SERIAL) The BlueVue Device Manager message box displays "Detecting modem on COMx" and then "Modem is not responding"

Possible cause:

BlueVue Device Manager and the modem are using different serial port settings.

Troubleshooting:

Installing BlueVue Device Manager 1.7.1 or later will allow communication with a modem regardless of its serial settings.

6. The BlueVue message box displays "[Modem]...is not responding to expected commands"

Possible cause:

The modem's firmware and BlueVue Device Manager are incompatible because either or both versions are not current.

Troubleshooting:

Upgrade the modem's firmware to the latest version.

Uninstall BlueVue Device Manager, and then install the latest version.

Appendix F : Activation Troubleshooting

When the modem is connected to the cellular network, its LNK LED will stay on, and BlueVue Device Manager's Modem Diagnostic screen will display a WAN IP. If the modem is not connected, the LNK light will be off, or intermittent, and the displayed WAN IP will be "N/A". This appendix covers issues with connecting to the network. If your modem is connected to the network but you cannot browse the internet, refer to Appendix X.

All the following conditions must be met before a modem can connect to the cellular network:

1. The modem must be within coverage, and have an acceptable RF signal strength
2. The modem must be activated for use on the cellular network
3. The modem must be configured to connect to the cellular network
4. If the cellular carrier requires a user name and password, the modem's connection parameters (WAN Settings) must be configured

1. Verify the signal strength

The modem's **REG LED should always be flashing** when it has a strong enough signal to detect a cellular network. Additionally, the signal strength is displayed in the information box in the top right of the BlueVue Device Manager window. The minimum required for communication is 1 signal strength bar; however, a signal this weak is not likely to provide a stable connection.

If the REG LED stays on, or if the signal strength is lower than -98 dBm (such as -105 dBm), **there may be an issue** with the antenna or the modem may be in a low coverage area.

Figure 37

2. Confirm the activation's success

Once a modem has been activated, BlueVue Device Manager will **display its phone number** in the WAN (Modem WAN Settings) screen.
If the phone number is blank, or does not correspond to the account's phone number, then activation has not been performed. Follow the instructions written in the **Quick Start Guide** that shipped with the modem to perform activation. The Quick Start Guide is also available at www.bluetreewireless.com.

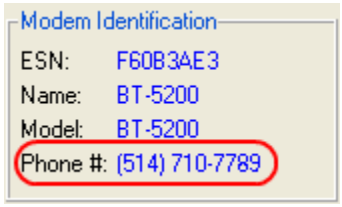


Figure 38

3. Configure the Connection Initiation

The modem must be configured to connect to the network.

To do this, open BlueVue Device Manager and navigate to **WAN (WAN Settings)**, and then ensure that the following settings are applied:

- The **Dial String** is **#777**
- The **Connection Initiation** is **Always On**

Click **Submit** to apply any changes. The modem should now connect to the cellular network. Refer to this section's introduction for instructions on how to verify whether your modem is connected to the network or not.

4. Configure the User Profile

If the modem's **LNK LED turns on** for a few seconds then **turns off**, this indicates that **authentication** on the cellular network is **failing**. The modem's User Profile will need to be configured.

Navigate to **WAN (WAN Settings)**. Enter the **user name** and **password** as provided by the cellular service provider.

5. Conclusion

As mentioned previously, when the modem is connected to the cellular network, BlueVue Device Manager's Modem Diagnostic screen will display a **valid WAN IP** and the **LNK LED will stay on**.

Figure 39

If after going through all of the above troubleshooting steps, the modem still does not acquire a WAN IP, then it is very likely that the account is not enabled by the cellular carrier, or that there has been a mix-up on the carrier side with the account details. Contact the cellular service provider and ask them to confirm that the phone number assigned matches the modem's ESN (electronic serial number) as shown in DIAG (Modem Diagnostic), and that the account is ready to be used.

Appendix G : Application & Miscellaneous Troubleshooting

This appendix assumes that the modem is currently online, and therefore the problem cannot be attributed to a lack of connectivity. BlueVue Device Manager's Modem Diagnostic screen should be displaying a valid WAN IP, i.e. an IP other than "N/A". If this is not the case, refer to Appendix F: Activation Troubleshooting.

1. You cannot browse the Internet

Possible cause #1 (Ethernet only):

The computer's local IP configuration is incorrect.

Troubleshooting:

The computer must be in the same subnet as the modem and must have the modem set as its gateway. The easiest way to achieve this is to enable automatic IP configuration (DHCP) on the computer.

1. In Windows XP, go to **Control Panel > Network Connections** and select the **local area connection** that corresponds to the Ethernet port in the "LAN or High-Speed Internet" list (it's usually "Local Area Connection 1").
2. Right-click the connection and click **Properties**. Select **Internet Protocol (TCP/IP)** in the list and click **Properties**.
3. Write down the existing values in order to restore them if needed, then select **Obtain an IP address automatically** and **Obtain DNS server address automatically**. The computer will now be ready to use the modem to access the Internet.

Possible cause #2 (Serial only):

You're connected to the modem using a serial cable and did not start a Dial-Up Networking session.

Troubleshooting:

Unlike Ethernet/USB, you must **configure Windows** to use a serial cable to access the network. Even though the modem is connected to the Internet, your computer is not configured to browse the Internet through the modem.

You will need to **install a standard 33600bps modem driver** and **create a Dial-Up Networking session** in order to be able to browse the internet. **Refer to Appendix D** for a walkthrough for creating a Dial-Up Networking connection in Windows XP.

Possible cause #3:

Your web browser is configured to use a proxy which cannot be accessed by the modem.

Troubleshooting:

1. **Open a command prompt window** by clicking Start > Run then entering "cmd" in the Run window.
2. At the command prompt, type **ping google.com** and press Enter.

If you get a "Reply from xxx.xxx.xxx.xxx: bytes=32 time=xxxms TTL=xxx" response, then your web browser is configured to use a web proxy which is preventing you from browsing the Internet through the modem. Consult your network administrator for help on fixing this issue.

Possible cause #4:

The cellular account does not allow web access.

Troubleshooting:

Certain cellular accounts, particularly those where security is a high concern, do not allow web access. If you are attempting to test the connection by browsing the Internet, you may not be able to do so because of this account restriction.

2. (ETHERNET/USB) You cannot communicate with a computer/device behind the modem

This section is meant for USB/Ethernet connectivity. If the device is a serial-only device, skip to the next issue.

Possible cause #1:

Your cellular carrier is operating a firewall which is blocking your attempts to connect.

Troubleshooting:

Certain carriers have a firewall turned on by default that blocks all incoming connections.

1. **Open a command prompt window** by clicking Start > Run then typing "command" in the Run window
2. Type **telnet xxx.xxx.xxx.xxx 6070** where x is the modem's WAN IP as assigned by the carrier

If you do not connect and see a "Welcome to BlueTree Wireless" message, then your carrier is likely blocking incoming connections. Contact your cellular service provider and ask them to open the TCP and UDP ports you will be using to access the device.

Possible cause #2:

Your computer (from which you are initiating the connection) or network has a firewall blocking outgoing connections.

Troubleshooting:

Confirm with your IT technician that no firewall is blocking outgoing connections.

Possible cause #3:

You did not perform the appropriate port-forwarding rules on the modem.

Troubleshooting:

The modem must be configured to forward incoming traffic to the device, otherwise your connection attempts will never reach the device. Refer to Section 6: IP Networking Features for further details.

3. (SERIAL) You cannot communicate with a device behind the modem

First, make sure the modem is configured to enable outside communication with the attached device. Refer to the "Serial IP" section of the main guide for details. The troubleshooting steps below assumes the modem is configured properly.

Possible cause #1:

The modem and the device are using different serial port settings.

Troubleshooting:

Using BlueVue Device Manager, navigate to **CONF (Modem Configuration) > Serial Port**, and **change the serial port settings** to the same values as those of the serial device. If the CTS and RTS pins are partially (or both) disabled, set the modem to use no flow control ("none").

Possible cause #2:

The cable wiring is incorrect.

Troubleshooting:

Refer to Section 11.6 for details on the required cable type.

Possible cause #3:

The DTR signal is inconsistent.

Troubleshooting:

A flickering DTR signal will interrupt communication with the modem. The modem can be configured to ignore the changes in the DTR state. In BlueVue Device Manager, navigate to **CONF (Modem Configuration) > Serial Port**, and check the option to **Ignore DTR**.

Section 12: Warranty

BlueTree Wireless Data Inc. warrants its cellular modems against all defects in materials and workmanship for a period of one (1) year from the date of purchase. The sole responsibility of BlueTree Wireless Data Inc. under this warranty is limited to either repair or, at the option of BlueTree Wireless Data Inc., replacement of the cellular modem. There are no expressed or implied warranties, including those of fitness for a particular purpose or merchantability, which extend beyond the face hereof. BlueTree Wireless Data Inc. is not liable for any incidental or consequential damages arising from the use, misuse, or installation of the BlueTree Wireless modem. This warranty does not apply if the serial number label has been removed, or if the cellular modem has been subjected to physical abuse, improper installation, or modification. The unit is automatically registered for warranty at the date it is purchased and/or shipped.

Customer Support

Toll-free	(877) 422-9110 option 2
Phone	(514) 422-9110 option 2
Hours	Mon. – Fri. 9:00 - 17:00 EST (Eastern Standard Time)
Fax	(514) 422-3338
Email	techsupport@bluetreewireless.com
Web	http://www.bluetreewireless.com
Address	BlueTree Wireless Data, Inc. 2425 46th Avenue Lachine, QC, Canada H8T 3C9